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Bibliography on Interspecific and Intergeneric Hybridization in Relation to Plant-Breeding	2	0
Account of the Research in Progress in the British Empire	3	6

Plant Breeding Abstracts.
Vol. II, No. 3.

Part I. British Empire

CYTOLOGY 576

324. DARLINGTON, C. D. 576.312.32:575
The bearing of chromosome studies on plant breeding.
Gdnrs.' Chron. 1931 : **90** : 192–93, 231–33, 272–73, 314–15, 351–53, 397–400, 430–32, 447–48, 461–63.

An explanation in popular terms of cell division is first given, followed by an indication of the significance of these facts with regard to vegetative propagation and the laws of heredity.

The occurrence of extra chromosomes, chromosome fragments and other chromosomal irregularities and their consequences are discussed with reference to specific cases, mostly taken from horticultural plants. Polyploidy is discussed with reference to plants arising directly from the corresponding diploid, then with reference to polyploids resulting from hybridization and leading to constant fertile hybrids. The role of polyploidy in the origin of cultivated plants is treated at some length. Among the probable results of polyploidy in many cultivated plants, notably the cereals, are pointed out: the existence of multiple factors ; the occasional pairing of chromosomes from the different parents, which has been observed in many so-called constant fertile hybrids and leads to segregation and the production of aberrant types such as fatuoids, speltoids and many others ; the phenomenon of " shift " in crosses between polyploids, resulting from new chromosome combinations ; the origin of many valuable new forms by crossing polyploid species having the same chromosome number ; the sterility in crosses of species having uneven numbers of chromosome sets and the unsuitability of cultivated triploids, e.g., of apples and pears, for further breeding ; the secondary polyploidy to which the Pomoideae are thought to owe their peculiar fruit characters.

325. WATKINS, A. E. 576.356.5:581.162.5
Hybrid sterility and incompatibility.
J. Genet. 1932 : **25** : 125–62.

A study of sterility in wheat hybrids revealed the possible effect of unbalanced chromosome relations between the embryo, endosperm and mother plant on subsequent development. This might be due to qualitative or quantitative differences between the tissues concerned. In the present paper the data bearing on the latter aspect are reviewed in connection with the relation of pollen tube to style, fertilization, seed development, chimaeras and the origin of triploids and tetraploids from diploids.

The normal ratio between pollen tube and style is 1 : 2 and as a rule, if this is changed to 1 : more than 2, growth is still usually normal but if it becomes 1 : less than 2, growth is reduced. The evidence for the effect of quantitative differences on fertilization is scanty and the possible irregularities are many.

In seed development the rule generally holds that the seeds develop better when the female gamete has the higher chromosome number. The effect is due to quantitative and qualitative relations between endosperm and embryo, the relation between these and the mother plant apparently having little importance.

The limited data on chimaeras suggest that tetraploid tissue has some difficulty in maintaining itself among diploid tissue.

Tetraploids are likely to arise by somatic doubling in fertile diploids because of the restriction on the growth of the diploid pollen tubes but in sterile diploids the occasional union of diploid gametes is likely to occur and triploids may be more frequent.

326. HURST, C. C. 633:575(47)
The Russian experiments in plant breeding.
Emp. Cott. Grow. Rev. 1932 : 9 : 4–20.

The author points out that the fundamental basis of Russian plant breeding is the Linnean species or some similar genetic entity composed of several Linnean species. The aim is to discover the old local races of crop plants ecologically suited to each of the diverse regions of the U.S.S.R. and by crossing these with modern varieties to incorporate them into new and virile races containing the most valuable genes of both old and new. Such a programme necessitates extensive collections and studies of geographical material and the tracing out of the centres of gene richness and diversity for each crop.

The author pays tribute to the extensive and systematic way in which the Russian workers have carried out this work, which has led to the introduction of many thousands of new and valuable genes into the country, and to the success with which the wealth of new material is being utilized in intra– and interspecific hybridization. This is illustrated by way of a brief review of the work of the last two years in cotton. The author lays considerable emphasis on the importance which the origin of a constant fertile hybrid by chromosome duplication would have if such could be discovered or induced in sterile interspecific cotton hybrids or the recently reported hybrid between Arizona cotton and the genus *Thurberia*. The way in which such fertile hybrids have arisen in other interspecific and intergeneric crosses is described and illustrated and their importance in the future of plant breeding indicated.

327. MEHTA, T. R. 633–2–1.521.6:575
Breeding of disease-resistant crops.
Agric. and Live-stock Ind. 1931 : 1 : 618–30.

The article starts with a general discussion of plant diseases and their control, in which the importance of breeding for resistance is emphasized. The author then gives a more general account of the problem with special reference to black stem rust in wheat ; attention is called to the importance of physiological forms, hybridization of forms and mutation, and the necessity for looking out for mature plant resistance, the significance of and obstacles to interspecific crossing.

328. STUDENT. 633.00.14
Yield trials.
Article in Bailliere's Encyclopaedia of Scientific Agriculture, ed. H. Hunter, 1931.

A very good account of the methods in use in experimental work, including a description of a new design which seems likely to be of very great utility.

329. BECKETT, W. H. 633.00.14:519.24
Field experiments. A note on residual variance in field experiments.
Trop. Agriculture 1932 : 9 : 7–10.

Certain supplementary methods of calculation to those given by Maskell in an earlier series of papers in the same journal.

330. 633.00.15(54)
Review of Agricultural Operations in India 1928-29.
Imp. Counc. Agric. Res. Pusa 1931. 251 pp.

A useful survey of the aims and objects of agricultural research in India with an indication of success attained in the several fields. Results in the field of plant breeding have mostly taken the form of the evolution of new varieties giving higher yields, of enhanced quality or better adapted to the local conditions than those previously cultivated. This is made clear in the sections on rice, wheat, cotton, sugar cane, oil seeds.

Items likely to be of particular interest to plant breeders are the production of a number of wilt-resistant strains of cotton, combining resistance with high yield, good staple and ginning percentage ; the production of improved sugar canes by selfing desirable parents and the extension of the number of possible hybrid combinations by improved methods of storing the pollen ; a new variety of *Hibiscus Sabdariffa* L. characterized by immunity to a local disease and unbranched stems longer than the local *Hibiscus* hemps ; the combination of the oil type of seed with the habit and root system suitable for local cultivation in a new hybrid linseed ; the occurrence of a giant mutant of gram (*Cicer arietinum*) ; the isolation of productive wilt-resistant varieties of gram and pigeon pea (*Cajanus indicus*) and the discovery of certain types of the latter resistant to an unknown sterility disease.

331. AAMODT, O. S. 633.1:575
The origin of the principle underlying elite stock seed production of cereal crops.
Circ. Univ. Alberta Coll. Agric. 1931 : **12** :
Also Ann. Rep. Canad. Seed Growers Assoc. 1930/31 : 95–104.
A review of cereal breeding from the time of Le Couteur in Jersey to the present day in Canada.

332. GORDON, G. S. 633.11:575(94.5)
Wheat breeding. The production of new varieties.
J. Dept. Agric. Vict. 1931 : **29** : 521–24.
A very brief general account of wheat breeding in Victoria. A small bird-proof cage has been fitted with electric light for comparing varieties under different lengths of day. By this means also two and even three generations have been grown in one year.
The origin of various new varieties is stated. The majority of these have been bred at the local research stations.

333. HARRINGTON, J. B. 633.11:575:578.08
Predicting the value of a cross from an F_2 analysis.
Canad. J. Res. 1932 : **6** : 21–37.
In the F_2 of the cross Marquillo x Marquis resistance to form 21 of *Puccinia graminis tritici* appeared in only 11 out of 78 families, indicating the action of three main factors. There was a close relationship between these results and the field reaction. Thus only 1·5 per cent of the F_2 plants resembled the resistant parent.
Height of plant also seemed to be dependent on several factors, only 6 out of 356 F_2 plants had grain equal to Marquis in appearance. The parent varieties did not differ much in yield and the hybrids seemed at least to equal them.
On the ground of these results it was calculated that 1 plant in 5760 would be likely to possess the desired combination of characters if they were all independently inherited ; this is without taking into account milling and baking quality. Actual breeding work on a similar F_2 population of this cross initiated some years earlier has led to the production of 6 good lines only, and none of these is up to the original expectations. Only three of them are as resistant as Marquillo, none equals Marquis in height, the yield is below the average of the parents, apparently on account of some genetic linkage. They are moreover inferior in crumb colour to both parents. In reaction to root-rot organisms and covered smut the parents were not greatly different and the hybrids were not inferior.
These results clearly illustrate the author's principle that a study of the F_2 will give a fairly reliable indication as to whether useful lines are likely to arise from the later generations of a cross. Several other crosses have indeed given much more favourable results.

334. KADAM, B. S. and NAZARETH, B. 633.11:575.061.6:581.46
Inheritance of awn colour in wheat.
Ind. J. Agric. Sci. 1931 : **1** : 663–70.
The black-awned, Kala-khapli 560 (*T. dicoccum*) was crossed with the red-awned Bansi 103 (*T. durum*). The F_1 was black-awned. F_2 segregated into black, red and white awned plants with a dihybrid ratio of 12 : 3 : 1. In F_3 black and red awned plants segregated in monohybrid ratios. The white awned plants bred true. The genic composition of the parents is therefore BBrr and bbRR respectively.

335. HUSKINS, C. L. 633.11:575.114–181.3:576.312.38
A cytological study of Vilmorin's unfixable dwarf wheat.
J. Genet. 1931 : **25** : 113–24.
The ever-splitting dwarf plants were found to have 43 chromosomes instead of the normal 42. Associations of 3 chromosomes were frequently observed and occasionally 5 were associated. Sometimes the chromosomes so involved were shorter than those observed in other instances.
Pigmy plants which segregated from the dwarf possessed 44 chromosomes, and the normal segregates possessed 42 but had frequent quadrivalent configurations consisting of 2 long and 2 short chromosomes.
It is thought that segmental interchange has occurred between not strictly homologous but phylogenetically similar chromosomes.

336. WATKINS, A. E. and CORY, F. M. 633.11:575.127.2:576.356.7
Genetic and cytological studies in wheat. V.
J. Genet. 1931 : **25** : 55–90.
A genetical analysis is presented of various characters in a cross between a hexaploid and tetraploid wheat, some of the characters being located only in those chromosomes which pair, others both in these and in the ones which do not pair. The former group of characters was inherited in a regular Mendelian fashion.
In the case of the second group the types of gametes and zygotes to be expected are worked out with respect to the waxy gene for the backcross F_1 ♀ x *turgidum* ♂, in which the chromosome number is less than 35 and for the backcross with *vulgare* where the chromosome number is 36–42. The 35 chromosome type, having all 7 extra chromosomes once only, differs from the other two groups.
The actual experimental results are then described and are seen to fit in with the expected. It seems to be confirmed in this way that *T. turgidum* has the formula (WW) for waxiness and *T. vulgare* (ww) W′W′. In the backcross with *turgidum*, the ratios from (Ww) plants were 3 : 1, from (Ww)W′ (W′ being in the unpaired chromosome) 5 or 6 : 1 and from (ww)W′ 1 : 2 or 3. In the case when *turgidum* was used as female the plants from the wrinkled grains segregated in either 5 : 1 or 3 : 1, those from the plump grains (supposed to have no extra chromosomes) only in 3 : 1 as expected, in this way affording a confirmation of the correctness of the assumptions.
Waxless plants were exceptional in the progeny from the *vulgare* backcross, since these all had 36 or more chromosomes and the W′ set was therefore always represented once at least ; waxless plants when they appeared were mostly sterile, i.e., combinations lacking the extra W′ set ; waxless fertile combinations were very rare and the fact that they occurred at all is thought to be due to irregular pairing in (ww) W′ individuals, by pairing of w and W′ and leaving the other w unpaired. If this happened a certain number of w and ww gametes would be produced, leading to the formation of the zygote (ww) w.
From this it is clear that in the F_1 (Ww) W′, the W from *turgidum* pairs with the w from *vulgare*, i.e. allosyndetically, leaving the other *vulgare* chromosome unpaired ; exceptional cases, such as that referred to above, of autosyndesis might occur.
From the high proportion of individuals almost identical with *turgidum* which occurred in the backcross progeny with *turgidum*, it is concluded that the majority of chromosomes in *vulgare* and *turgidum* are alike and that most of the differential characters are contained in a small number of chromosomes.

337. WESTON, W. A. R. DILLON 633.11–2.451.3:576.16
The relative resistance of some wheat varieties to *Tilletia caries* (DC.) Tul. (= *T. tritici* (Bjerk.) Wint.)
Ann. Appl. Biol. 1932 : **19** : 35–54.

Experiments are described which shew that a so-called resistant variety may be very severely infected when inoculated with bunt produced on plants of that variety and that the virulence of the bunt may be considerably enhanced by passing through these resistant varieties. From this it is argued that *T. caries* consists of a number of physiological forms differing in virulence. Hybridization experiments are described which shew that susceptibility is dominant in crosses between resistant and susceptible forms ; by infecting the seed of F_2 plants with bunt obtained from both parents and from the F_2 plants no F_3 family free from bunt was obtained. When one of the parental bunts was omitted in these inoculations certain lines behaved as resistants.

338. WELSH, J. N. 633.13–2.452:576.16:575.11
633.13–2.451.3–1.521.6:575.11
633.13:575.061.6:581.46
The inheritance of stem rust and smut reaction and lemma colour in oats.
Sci. Agric. 1931 : **12** : 209–42.

The author begins with a rather full review of the literature on the three subjects of the paper. With regard to rust reaction, several crosses were studied both in the field and in the greenhouse. Studies of the field infection of F_2 and F_3 and the greenhouse infection of F_3 in the cross Heigira Strain x Banner shewed resistance to be dependent upon one dominant factor. This factor was shewn to be responsible for resistance to forms 1, 2, 3, 5 and 7.

This resistant Heigira Strain was next crossed with Joanette Strain which is resistant to form 4. In this case 9 : 7 ratios were evident in F_2 with regard to form 4. The strain (Minota-White Russian x Black Mesdag) resistant to both loose and covered smuts was crossed with Joanette Strain. The results shewed that resistance to rust form 4 was here dependent on a single factor. It was also crossed with Richland, resistant to rust forms 4, 6 and 8, and rust resistance again proved to be dependent on a single factor ; this was also the case in Markton x Heigira Strain. Correlation studies shewed an absence of association between maturity and rust reaction, maturity and lemma colour or rust-reaction and lemma colour. Certain possible associations are indicated later.

The cross Victory x (Minota-White Russian x Black Mesdag) shewed an association between resistance to loose and covered smuts. Transgression occurred in the direction of susceptibility ; two dominant factors at least are concerned.

Artificial infections with two rust resistant varieties shewed that rust infection was greater on those plants attacked by smut than on smut-free plants.

As a result of observations on lemma colour in F_2's and one F_3 it appeared that white was in some cases dominant and in others recessive to yellow, one or two factors being operative ; black was dominant to white, dependent on two factors, the one for black being epistatic on one for grey. In a black/yellow cross the ratio of 12 black : 3 white : 1 yellow was observed in F_2

Under rust-free conditions certain rust resistant strains from the first cross yielded more highly than the Banner parent and some of these were characterized by tall, strong straw, medium earliness and low husk percentage. These will be used in crossing with strains from the second cross which are resistant to forms 1, 2, 3, 4, 5 and 7.

339. HUSKINS, C. L. 633.13–2.8–1.521.6
Blindness or blast of oats.
Sci. Agric. 1931 : **12** : 191–99.

The number of sterile spikelets was shewn by statistical analysis to be less in wild than in Banner oats and probably more in a strain of false wild oats from Banner than in the original Banner. The amount of blast did not appear to be influenced by hybridity and the author is of opinion that it would be profitable to undertake a search for resistant varieties with the object of breeding for resistance.

340. RANGASWAMI AYYANGAR, G. N. 633.17:575.1(54)
Sorghum—the great millet.
Madras Agric. J. 1932 : **20** : 18–27.
An account of sorghum breeding and cultivation in India.

341. RANGASWAMI AYYANGAR, G. N. 633.17:575.11
The inheritance of characters in ragi, *Eleusine coracana* Gaertn.
Madras Agric. J. 1932 : **20** : 1–9. (19th Indian Sci. Cong., Bangalore, 1932.)
A resumé of the work done on the inheritance of the various characters.

342. RANGASWAMI AYYANGAR, G. N. and KRISHNASWAMY, N. 633.17:575.11:581.162.5
The inheritance of characters in ragi, *Eleusine coracana* (Gaertn.), Part III. Sterility.
Ind. J. Agric. Sci. 1931 : **1** : 554–62.
A type of sterility in which the anthers fail to dehisce although the pollen grains may be viable is described. By selfing individual ear-heads the character bred true. A considerable amount of natural crossing occurred in such plants from normals. This was often evidenced by the occurrence of purple plants in the progeny of white ones ; the segregation ratios for sterility and pigmentation are given. The results of four generations shew that sterility is governed by a simple recessive.
A second type of sterility is described which takes the form of the agglutination of the pollen grains, which are almost all non-viable. The character is determined by a simple recessive, distinct from the first.

343. RANGASWAMI AYYANGAR, G. N., KRISHNA RAO, P. and ACHYUTHA WARIAR, U. 633.17:575.11.061.6:581.48
The inheritance of characters in ragi, *Eleusine coracana* (Gaertn.), Part II. Grain colour factors and their relation to plant purple pigmentation.
Ind. J. Agric. Sci. 1931 : **1** : 538–53.
The study of the F_2 families, carried on to the F_3 and F_4 in certain cases, led the authors to conclude that brown grain colour was conditioned by 2 factors, in the absence of both of which the grain was white and that purple pigmentation in the plant was produced by the action of a supplementary factor on one of these two pigment factors. The figures on which these conclusions are based are presented.
A cross involving two green plants, one wanting the pigment factors and the other having one of these but lacking the supplementary, gave the expected purple plants with brown grain in F_1. There is a further independent factor which deepens the brown colour of the grain.

344. RANGASWAMI AYYANGAR, G. N., KRISHNA RAO, P. and KRISHNASWAMI, N. 633.17:575.11.061.6:581.48
The inheritance of characters in ragi, *Eleusine coracana* (Gaertn.), Part IV. Depth of green in the pericarp.
Ind. J. Agric. Sci. 1931 : **1** : 563–68.
The light-green pericarp type described was found to have an average of nine chloroplasts per cell in the pericarp, as opposed to fourteen in normal plants. F_2 segregation figures from a number of natural crosses are presented, shewing that the character is a simple recessive and independent of factors influencing purple plant pigmentation and brown grain. These conclusions were confirmed by artificial crosses.
The same factor is also responsible for a reduced depth of tint of the dry anthers.

345. RAMGASWAMI AYYANGAR, G. N. and KRISHNA RAO, P. 633.17:575.11.061.63
The inheritance of characters in ragi, *Eleusine coracana* (Gaertn.), Part V. Albinism.
Ind. J. Agric. Sci. 1931 : **1** : 569–76.
The numerical results presented shew that thirty families were segregating in a 15 : 1 and twenty-seven in a 3 : 1 ratio for normal green. Green lines have been isolated, each wanting in one of the two chlorophyll factors, from the cross of which albinos segregate in F_2 in the proportion of 1 in 16.
These factors were independent of the factor producing differential depth of pericarp green.

346. RANGASWAMI AYYANGAR, G. N. and NARAYANAN, T. R.
633.171:575.11.061.6:581.48
The inheritance of characters in *Setaria italica* (Beauv.) the Italian millet, Part I. Grain colours.
Ind. J. Agric. Sci. 1931 : **1** : 586–608.
A study of a large number of natural hybrids, supported by later artificial hybrids of certain extracted types, led to the following factorial explanation : a factor K is present in the black group of seed colours designated black, tawny buff and Korra buff and absent in the non-black types designated sepia, red and tawny red. By the action of a second factor I, Korra buff and tawny red are respectively converted into tawny buff and red, which in turn are transformed by a factor B into black and sepia respectively. The effect of B is only manifested in presence of I.
Figures for F_2 and F_3 generations, and in certain cases up to F_5, forming the basis for these conclusions and involving over 500 families from the natural hybrids and three sets of artificial crosses, are tabulated.

347. ALAM, M. 633.18:575
The problem of rice breeding. (With special reference to Bihar and Orissa conditions.)
Agric. and Live-stock Ind. 1931 : **1** : 497–511.
The varietal diversity in Indian rices is so great, the greatest field for improvement at the present time is still that of pure line selection. Owing to this varietal diversity the work requires to be done on a very large scale. Lines selected for one district are usually not suitable for others and therefore the work must be carried out at a number of distinct stations. The limited adaptability of the rice plant makes these difficulties particularly acute and the production of an adaptable type is highly desirable.
The value of various characters in classification and as distinctive features for new varieties is discussed. The author regards awn length as a rather constant varietal character ; figures are given which indicate that it is conditioned by two factors. Comparative earliness is regarded as a clear and important varietal character as well as resistance to drought and flooding and height of plant. In addition to these a number of other important agricultural characters have been taken into account in the study of varieties and were found to approach constancy with the increasing purity of the strain and evidence is cited which indicates that they are governed by Mendelian laws.
The urgent necessity of a knowledge of the factors which determine yield is pointed out.

348. 633.18:575(91)
Padi experiments in Malaya, 1930-31.
Malayan Agric. J. 1931 : **19** : 577–92.
Selection. Selection has been continued on four popular varieties. The yields of the best strains are tabulated and their chief characteristics described.
Promising results were given by mixtures of the four good strains.
Breeding. Ten very robust plants with very high tillering capacity were isolated from an artificial cross. A satisfactory crossing technique has been established and further hybridizations will be made.
Experiments have been laid out to determine the amount of natural crossing.

349. JAGOE, R. B. 633.18:575.12
Hybridization of selected strains of padi.
Malayan Agric. J. 1931 : **19** : 530–34.
A brief description is given of the flowering of the rice plant, the author's methods of artificial hybridization and bagging and the course of grain maturation after hybridization.
Over 100 hybrid grains have been obtained by these methods, of which twenty-five germinated and sixteen gave mature plants. Certain parental combinations were more successful than others, some varieties being noticeably more suitable female parents.

350. DAVEY, V. McM(ASTER) 633.426:575.061.6
Inheritance of colour in *Brassica Napus*.
J. Genet. 1932 : **25** : 183–90.
A factor N_1 for marked anthocyanin colour in swedes, *Brassica Napus* L. var. *Napobrassica* (L.) Petrm. is substituted for the P_1 of Kajanus and its definition is based on the colour between the leaf-scars on the " neck." Crosses between plants with N_1 and another strain with purple-neck shewed the presence of another independent factor for purple colour, N_2.
No linkage was found between N_1 and N_2 and the factors M_1 and M_2 for white flesh colour.
It is suggested that there may be some connection between these duplicate factors and the polyploidy of *Brassica Napus*.

351. MEGAW, W. J. 633.491–2.8–1.521.6
The improvement of stocks of potatoes by selection.
J. Minist. Agric. N. Ireland 1931 : **3** : 131–36.
Stocks were subjected to rigid and repeated selection, all plants with traces of virus being removed. Stocks of Arran Victory so selected produced an average yield of 3 tons 16 cwts. in excess of the unselected stock.

352. BURNS, W. 633.51:575(54.7)
The work of the Bombay cotton-breeders.
Agric. and Live-stock Ind. 1931 : **1** : 512–21.
An account of the development and results of the cotton breeders in the various areas of the Bombay Presidency. Among the most valuable achievements feature the production of a high-quality wilt-resistant strain Jaywant ; the development of the variety Banilla with greatly improved lint characters, from a cross of *Gossypium cernuum* with *G. indicum* ; and the establishment of a number of other varieties with improved yields and lint qualities.

353. KOTTUR, G. L., MUNDKUR, B. B. and MARALIHALLI, S. S. 633.51:575.11.061.6:581.46 633.51:575.127.2
Inheritance of corolla colour in some Indian cottons.
Ind. J. Agric. Sci. 1931 : **1** : 577–85.
In the cross Dharwar I (*Gossypium herbaceum*) x *G. sanguineum* the F_1 had red flowers but less intensely coloured than the *sanguineum* parent. Very clear monofactorial segregation occurred in F_2.
With *G. neglectum* sub. var. *cutchica* as the female parent the condition was similar in the F_1 but red, pink, yellow and white individuals appeared in F_2. Good agreement was obtained in F_2 and F_3 with expectations on a two factor basis.
Using *G. neglectum* var. *rosea* as female similar results to the latter were obtained.

354. BALASUBRAMANIAM, R. 633.51:581.163
Parthenogenesis in cotton.
Madras Agric. J. 1931 : **19** : 509–16.

The method used in making the crosses is described. A large number of crosses were made between *Gossypium indicum* ♀ and *G. hirsutum* ♂. In the early stages the fruits developed well and only between the 20th and 30th days did pronounced shedding set in. An examination of the fruits shewed that seeds of normal character and size had developed, although the interior was not completely filled up and the embryo was imperfectly developed.

Growth curves were compared with those for normal fruits. These shewed an abrupt cessation in growth at the end of three weeks.

A very small number of good seeds was produced. To test the possibility of their having arisen by parthenogenesis various plants of *G. indicum* were emasculated and the whole staminal column was removed. Out of 700 such flowers seven produced bolls and of these four gave good seeds with lint. Flowers treated in such a way gave no more mature bolls and seed when dusted with pollen of the same variety or left uncovered and the author is of the opinion that the seeds previously formed were the result of parthenogenesis. Cytological studies to test this are being undertaken.

355. FAHMY, T. 633.51–2.484–1.521.6:575.1
The genetics of resistance to the wilt disease of cotton and its importance in selection.
Bull. Tech. Sci. Serv. Cairo 1931 : **95** : 30 pp.

The percentages of immune, resistant and susceptible seedlings in a number of strains of various well-known varieties are given.

In crosses between immune and susceptible varieties the F_1 shewed immunity to be dominant and the F_2 contained immunes, resistants and susceptibles in percentages of 75·4, 15·8 and 8·8 respectively. The immunes and non-immunes were therefore present in the ratio approximately of 3 : 1. The results are tabulated. A second cross of different immune and susceptible varieties gave exactly similar results. F_3 families breeding true for immunity were obtained.

The variety Sakha 4 segregated for immunity. One plant chosen gave a progeny containing forty immunes : sixty resistants. The progeny of the same plant crossed by a susceptible contained six immunes, fifty-six resistants and thirty-eight susceptibles.

There were marked differences in a heterogeneous progeny in respect of the number of days taken for signs of infection to be manifested. The percentage of immunes was distinctly greater in the progeny of the plants with a long incubation period than in those with shorter incubation periods. Moreover the susceptibles which segregated from the cross heterozygous x susceptible often had not such short incubation periods as the susceptible parent ; and many of the resistant segregates had not such a long incubation as the heterozygous parent. This was still more true in the case of the susceptibles from the cross immune x susceptible.

For a number of years resistant plants occurring in the susceptible variety Sakel. were isolated. It finally became clear that they were different in type from the main bulk, having shorter staple. A study of a number of populations growing on various types of field shewed that the majority of plants of this variety were of long halo-length and extremely susceptible. Some plants, however, were equally susceptible but had short haloes. Certain isolations also had fair halo-length combined with immunity. These are distinct from the original type and have had to be subjected to further selection, with the result that two heavy-yielding immune strains have been established which possess lint resembling Sakel.

The author considers that a more successful method lies in selecting for resistance in strains which have already been selected for lint qualities regardless of wilt reaction. Experiments shewed that such families differed markedly in reaction and a high quality, almost immune variety, Sakha 4, has already been produced in this way. In halo length it was superior to the original Sakel. and by further selection a completely immune type has been attained. This is being multiplied under the name Myco 5.

356. 633.61:575(54)

The existing organisation and scope of sugar cane research and experimental work in India.

Rep. Proc. Imp. Sug. Cane Res. Conf. Lond. 1931 : 104–07.

The work in progress at the Coimbatore Station includes :—studies in time of flowering, improvment of breeding and nursery technique, involving methods of pollination, germination, preservation of pollen and of seeds and stigma receptivity ; a study of seedlings for testing the quality of mother cane and for inheritance of characters, resulting in certain parents being ruled out ; the choice of a particular parent for particular characters desired ; classification of canes ; study of root system and breeding for different types ; estimation of quality of juice ; morphology and its connection with resistance to disease and animal pests ; a study of wild canes, their hardiness, root systems and disease resistance.

The canes for North India are tested in a substation recently established there.

357. 633.61:575(72.92)

Present state of sugar cane experiments in Jamaica.

Rep. Proc. Imp. Sug. Cane Res. Conf. Lond. 1931 : 128–29.

Uba has been successfully crossed with large West Indian canes but the hybrids proved susceptible to mosaic. Importations have therefore been resorted to, Uba and more recently Java mosaic-resistant canes have been widely cultivated, giving successful yields owing to their resistance.

358. 633.61:575(72.98)

Sugar cane research in Barbados.

Rep. Proc. Imp. Sug. Cane Res. Conf. Lond. 1931 : 115–27.

A historical review of breeding in sugar cane is given, starting with the first discovery of the growth of sugar cane from seed followed by the introduction of White Transparent, then Bovell's work to produce seedlings of commercial value resistant to the rind fungus *Colletotrichum falcatum*, by free pollination of the mother which proved very successful, culminating in 1912 with B.H. 10. An account of the present work follows. Seedlings are grown in such a way as to indicate what characters each parent is transmitting, which is leading to the production of canes giving more sugar per acre.

As parents, Barbados varieties, imported varieties and the hybrids between the two are selected. The flowering must thus be studied for all these and the relative compatibility of crosses.

Studies of growth measurements of seedlings are being made every fortnight at two stations and the period of maturity is noted, including sucrose percentage at various seasons.

Each year the sixty best seedlings (of various periods of maturity) are retained and subjected to fuller examination and investigations are being made to determine resistance to gumming, *Bacterium vascularum* and the correlation between yield of cane and sugar in successive crops. Root system investigations are anticipated.

The chart of procedure is given by the Geneticist, which includes " cistern selection " experiments to estimate the value of seedling selection in the potted stage, the testing of promising seedlings in different places, etc.

Selfing is only carried out to determine varieties suitable for female parents. By examining each " batch " of seedlings (from a parent) for each character it is possible to judge the value of parents as transmitters. The examinations extend over a number of years before a final decision is made, the varieties being tested at two places and for three reaping times—early, medium and late.

Male or self-sterile plants are used as females and also enclosed in an arrow lantern device prior to and during arrowing. Habit, ease of trashing, number of canes, their length and width and weight of stool are determined, sucrose determinations also.

Significant differences have been obtained between " batches " in all features, indicating genetic differences.

In recent work Java varieties have also been used as parents, to introduce the wild parentage and genes. The result was a greater range of variation, greater weight but sucrose usually low. This is raised by crossing with Barbados canes. Hybrids are being backcrossed to Barbados canes to retain weight, appearance and drought resistance combined with the juice quality of Barbados canes.

359. 633.61:575(88)
Sugar cane research in British Guiana.
Rep. Proc. Imp. Sug. Cane Res. Conf. Lond. 1931 : 108–14.
The objects in view are to create about 10,000 seedlings yearly, to determine the best mother cane varieties or hybrids, Javanese and other descendents of *S. spontaneum* being used, to test these and other varieties, to isolate a strain pure for sucrose content by selfing and progeny row selection and to study the inheritance of characters as far as possible.

360. WILLIAMS, C. H. B. 633.61:575(88)
The breeding and selection of cane seedlings, with special reference to D. 625.
Agric. J. B. Guiana 1931 : **4** : 189–94.
A historical account of the trial and introduction of this cane, as seen from the annual reports.

361. DARRAGH, W. H. 633.61:581.48:578.082
The viability of sugar cane seed. A problem in seedling raising in New South Wales.
Agric. Gaz. N.S.W. 1931 : **42** : 852–54.
The life of sugar cane seed has been greatly prolonged by storing in atmospheres dried with calcium chloride ; carbon dioxide and reduced temperatures still further increased the viability. By these methods successful germinations have been obtained with seed imported from great distances.

362. WOOD, R. C. and PATERSON, D. D. 633.61.00.14
A variety test of sugar-cane.
Trop. Agriculture 1932 : **9** : 14–21.
The results shew clear varietal differences which were made evident by a combined statistical analysis of the data for four years.

363. BARBER, C. A. 633.61.00.15
Recent advances in plantation research.
Int. Sug. J. 1932 : **34** : 4–10.
Amongst the various factors which have contributed to the revolution in cane agriculture the part played by breeding is mentioned and the most outstanding advances in this branch of the science are outlined.

364. SRIVASTAVA, R. C. 633.61.00.15(54)
A note on sugar research in India.
Agric. and Live-stock Ind. 1931 : **1** : 533–42.
The article includes a section on the work of breeding improved varieties and associated problems, detailing the organization, methods and results of the Imperial Sugar Cane Research Station at Coimbatore.

365. RAM, K. 633.71:575(54)
Studies in Indian tobaccos. No. 6. The improvement of Indian cigarette tobacco by hybridization.
Ind. J. Agric. Sci. 1931 : **1** : 455–72.

The crossing technique is described. A hardy, vigorous local type was crossed with the high quality American variety Adcock. The F_1 plants were in general intermediate between the parents ; they are described in detail. A large F_2 was grown and 200 promising hybrids selected and selfed. The 200 F_3 families were studied individually. All but ten of these were discarded almost at once, the ten retained proved to be homozygous for the characters studied.

In F_1 earliness tended to be dominant, transgression occurred in F_2, giving F_3 plants both earlier and later than the parental extremes. The same was true for height and number of leaves, for which characters the average in F_2 and F_3 was distinctly higher than F_1 or the parents. Leaf width behaved in a way similar to earliness.

The parental types were not recovered in F_2 and new types hitherto unknown appeared. One of these had large white flowers, broad ovate leaves and large stature ; it was apparently homozygous.

A classification of the hybrids based on morphological characters is given, followed by descriptions of the ten most promising. It is hoped that the vigour and adaptation to local conditions of the local strain will have been combined with the Adcock cigarette making quality and the hybrids are being tested by ground and flue curing methods.

366. EDEN, T. 633.72.0014
The experimental errors of field experiments with tea.
Bull. Tea Res. Inst. Ceylon 1931 : **6** : 21 pp.
Studies in the yield of tea. I. The experimental errors of field experiments with tea.
J. Agric. Sci. 1931 : **21** : 547–73.

The first gives the more general details of the arrangement of the experiment, results, etc., and the mathematical details are treated more fully in the second.

367. SALMON, E. S. 633.79:575(42)
Hops.
J. S.E. Agric. Coll. Wye 1932 : No. **29** : 23–24.

Continuation of previous work. Seedlings of the new " Manitoba " to obtain, if possible, hops with an English aroma as well as preservative value and semi-dwarf seedlings from Bramling are under examination.

368. DIXIT, P. D. 633.842:576.312.35
A cytological study of *Capsicum annuum*.
Ind. J. Agric. Sci. 1931 : **1** : 419–33.

The cell division in root tips and pollen grains is described and illustrated in some detail and the haploid number of twelve established for the species.

369. JACK, H. W. and JAGOE, R. B. 633.855.34:575.42
Variation in fruiting ability of oil palms.
Malayan Agric. J. 1932 : **20** : 14–19.

Based on yield determinations of a number of naturally pollinated palms the coefficient of variability proved to be 47 per cent. One quarter of the population (consisting of 149 poor palms) produced only 11 per cent of the total yield, whilst the best 30 per cent of the palms produced 48 per cent of the total crop ; the best 9·5 per cent produced 18 per cent of the total. This is an indication of the order of improvement which could be attained by selection. Selfed and cross-pollinated seed is being obtained to test the inheritance of these yield differences between the palms.

Artificially pollinated palms gave much higher yields than palms grown under estate conditions.

370. Thomas, P. H. 634.11:575(94.6)
Apple varieties raised in Tasmania. I. Tasma (Democrat).
Tasmanian J. Agric. 1931 : **2** : 171–74.
Tasma (syn. Democrat), one of Australia's most popular apples, originated in Tasmania as a chance seedling. It is a late dessert type with particularly good keeping qualities, is of vigorous growth and rather disease resistant ; its main features are described.

371. Oppenheim, J. D. 634.3:575.42
The selection of citrus trees, its importance and problems.
Hadar 1930 : **3** : (12) and 1931 : **4** : (1).
A statement of a number of general considerations to be taken into account by the citrus breeder, followed by an account of the author's work on selecting stocks. The seeds from a number of sweet lime trees were classified according to the size of the fruit producing them and according to weight. The germination percentages are given for the different classes. This was influenced by the tree producing the seed more than the size of fruit or weight of seed. Differences in germination and early growth were not reflected in the later development of the seedling trees.
The almost universal failure of fertilization in the sweet lime leads to the plants being more or less equivalent to a clone and selection is thus not likely to have much effect. Other methods, such as hybridization or even X-ray treatment will probably be necessary therefore to effect improvement.

634.771:575
372. Cheesman, E. E. 634.771:575.129
Banana breeding at the Imperial College of Tropical Agriculture.
Rep. Emp. Mark. Bd. 1931 : No. **47**. 34 pp.
The author gives a historical summary of the work of breeding the Gros Michel variety in the effort to add resistance to the Panama disease to its other valuable properties.
As the result of a very large number of pollinations 123 perfect seeds were obtained from two varieties, one of which was Gros Michel. These seeds with one exception came from pollinations with one or other of the seeded species. Five of the seedlings from the Gros Michel survived to the fruiting stage. One resistant variety of good quality was obtained, its only defect being the occasional production of seed. Backcrosses with Gros Michel were unsuccessful owing, as was shewn later, to the increased chromosome number of the hybrid.
An extensive collection and study of types and species of *Musa* is being made.
The author describes the methods of hybridization and various manifestations of sterility which are repeatedly encountered. The success obtained on using different varieties as female parent is shewn in tabular form.
The original cross which gave the valuable resistant hybrid has been repeated on a larger scale in the attempt to find a still more favourable combination of the two parents. The Gros Michel is also being crossed with other species, both edible and fully fertile. By planting a certain number of plants of another species amongst Gros Michel an attempt has been made to make use of natural cross-pollination.
The resistant hybrid I. C. 1 has also been backcrossed with its male parent and information may in this way be obtained as to the inheritance of resistance.
As an alternative, crosses are to be made between resistant varieties of other groups and for this a study was made of these groups. The numbers of seeds and germinations obtained in various crosses of the different groups are shewn. The majority of crosses failed to produce any viable seedlings but eight promising plants have grown from a cross involving the variety Fillbasket and *M. malaccensis* B. Certain other promising types are indicated.
In a cross of two widely divergent fertile species abundant seed was set and a number of hybrid plants, intermediate in characters between the two parents, were obtained. They were slightly fertile with the parents but almost sterile in selfs. The backcross with one of the two parents gave a uniform progeny and it is supposed that chromosome doubling has taken place. It is thought not improbable that the solution of banana breeding lies in the production of parthenocarpic polyploids in crosses between fertile species. Crosses are therefore to be made involving all combinations of all the species in the seeded types in the collection. The results of the crosses made so far are given in tabular form.

Part II. Foreign

STATISTICS 519

373. FISHER, R. A., IMMER, F. R. and TEDIN, O. 519.241.7:575–18
The genetical interpretation of statistics of the third degree in the study of quantitative inheritance.
Genetics 1932 : **17** : 107–24.

The application of statistical methods to the study of quantitative inheritance is carried in this paper to a further stage. A dominance bias in the heterozygote is indicated by a departure from normality of the F_3 progeny. The analysis of means, and even of variance, is thus insufficient to measure the bias, and statistics of the third degree are introduced. In the notation used k_1 is the sample mean, k_2 the estimated variance, while k_3 is an estimate of the third moment. Departure from normality is indicated by a negative k_3, and for large samples k_3 and the ratio $g = k_3/k_2^{\frac{3}{2}}$ can be examined in relation to their known standard errors. A metrical bias, due to the difference in variability of progeny from plots of high or low fertility, may also exist, and to separate this from the dominance bias a number of tests are suggested which should be carried out on a set of samples of F_3 progenies. (1) Mean value of the k_3 from each sample in the set, a significantly negative value of which will show a dominance bias ; (2) The k_3 of the means of different F_3 progenies, which should again be negative, but will not be determined very accurately unless considerable replication of the F_3 lines is carried out ; (3) The covariance of the k_1 and k_2 in different F_3 progenies, which will be positive if the dominance bias has operated alone, but which will be diluted by the disturbing effect of a metrical bias. All three are to be tested by their standard errors, for which the formulae are given, although it should be pointed out for the benefit of the reader that the k–notation in the paper is used in two senses, first as descriptive of the individuals in each sample, and secondly for the characterization of the distribution of these k's in all the sets of samples.

The special precautions it is necessary to take in experimental work of this kind are pointed out, and illustrations shew a general agreement with the theory put forward, although more extensive data will be required to fix the degree of dominance with any approach to exactness. The tests given are approximate only, but the assumptions involved appear reasonable so long as the samples are large. The non-significance of many of the results quoted should be a sufficient warning to the reader not to expect much from wholly inadequate data.

374. CHARLES, D. R. 519.251.9:575.114
A graph for standard errors of ratios.
Genetics 1932 : **17** : 31–37.

When p is a ratio of one type, determined experimentally from a sample of N individuals, the reliability of p is measured by its standard error

$$\sigma = \sqrt{p(1-p)/N}$$

A nomogram is given whereby with the use of a straight edge any required standard error can be determined from a given p and N without arithmetical calculation. A more accurate figure for laboratory use can be constructed from the data given in the paper.

GENETICS 575

375. HUSKINS, C. L. 575.129:576.16
The origin of *Spartina Townsendii*.
Genetica 1931 : **12** : 531–38.

The grass *S. Townsendii* appeared suddenly in 1870 and has since invaded thousands of acres in Southampton Water and other districts, both on this and the other side of the Channel. It is of great value for reclaiming land from the sea. It was early suggested that it was a hybrid of *S. alterniflora* and *S. stricta* ; it has appeared in the only two places where these two occur together. On account of its greater vigour the new species has almost eliminated the supposed parental species wherever it has come into contact with them.

The species is fertile and breeds almost true to type. Cytological examination by the author disclosed 126 somatic chromosomes, pollen mother cells at diakinesis shewing many bivalents and some multiple associations. Similar material of *S. alterniflora* shewed a somatic number of seventy and of *S. stricta* fifty-six. *S. Townsendii* is most probably therefore an amphidiploid arising from hybridization between these two species.

376. MÜNTZING, A. 575.129:576.356.5
Cyto-genetic investigations on synthetic *Galeopsis Tetrahit*.
Hereditas 1932 : **16** : 105–54.
A detailed comparison of the " synthetic " *Galeopsis Tetrahit* and the natural form from which it only differs in the amount of variation. The question of polyploidy is discussed.

377. HALDANE, J. B. S. and WADDINGTON, C. H. 575.14:575.116.1
Inbreeding and linkage.
Genetics 1931 : **16** : 357–74.
A mathematical study of the proportions of various genotypes in the final population when organisms heterozygous for the linked genes A and B are inbred according to various systems. viz :— (1) self-fertilization, (2) brother-sister mating in the case of sex-linked genes, (3) brother-sister mating in the case of autosomal genes, (4) parent offspring mating in the case of sex-linked genes, (5) parent offspring mating in the case of autosomal genes.
Five systems of equations are given for these cases and hold true whatever be the initial composition of the population, provided that it contains the genes A, a, B and b in equal numbers. The method of calculation is inapplicable to most other types of inbreeding.

378. BUCHINGER, A. 575.182:576.341
Die Zusammenhänge zwischen Saugkraft und plasmatischer Vererbung. (**The correlation between osmotic value and plasmatic inheritance.**)
Genetica 1930 : **12** : 539-61.
The hybrids of a cross of two barley varieties differing in osmotic value were different in all generations from F_1 to F_5, the osmotic value in all hybrids being equal to that of the female parent.
A number of cases of difference between reciprocal hybrids are quoted from the literature.
Selection for high osmotic pressure in a pure line of *Triticum durum* led to a marked rise in osmotic pressure and a corresponding increase in yield.
Further experiments with barley shewed that even when the hybrids from a cross were pollinated by a third, different variety, the segregates still remained unaltered with regard to osmotic pressure, being in F_8 identical with the original female. Similar results were observed in wheat crosses.
Fruwirth's constant *Lens-Vicia* hybrid was found to have an osmotic pressure equal to that of the male parent, indicating that in the formation of this hybrid the whole of the male cell must have functioned, with the total elimination of the female.

379. HAVASS, G. 575.24
Trifolium hybridumból mutáció utján létrejött *Trifolium fragiferum*, *Trifolium repens* és egyéb mutációk ismertetése. Geonológiai tanulmány a növényfajok keletkezéséről. (**Description of mutation from *Trifolium hybridum* to *Trifolium fragiferum* or *Trifolium repens*. Genealogical study of the origin of species.**)
Rep. Hung. Agric. Expt. Stas. 1931 : **34** : 17–33.
The author has observed repeated cases of mutation in many different species leading, it is stated, to the production of new species. Mutation generally occurs in the germinating seed or developing bud and is brought about, the author considers, by the effect of environment.

380. MULLER, H. J. 575.24
Heribert Nilsson's evidence against the artificial production of mutations.
Hereditas 1932 : **16** : 160–68.
The author discusses the theory advanced by Heribert Nilsson (see Plant Breeding Abstracts, Vol. II., Abst. 23) and states that in the majority of cases the mutant types have proved less viable rather than more. Amongst other evidence to refute Heribert Nilsson's view the increase of the mutation rate in both directions, reported by several authors, is quoted.

CYTOLOGY 576

381. HAGERUP, O. 576.16:576.356.5
Ueber polyploidie in Beziehung zu Klima, Ökologie und Phylogenie. Chromosomenzahlen aus Timbuktu. (**Polyploidy in relation to climate, ecology and phylogeny. Chromosome numbers from Timbuktu.**)
Hereditas 1932 : **16** : 19–40.
Observations were made in some of the most unfavourable growth situations of the whole world and the plants which inhabited them. *Eragrostis cambessediana* (whose chromosome number is 10) was found growing only on the seashore just where the soil and atmosphere are always moist but the plant is never inundated. The plant is an annual and dies as soon as inundation begins. *E. albida*, a very similar but tetraploid form, is a perennial and was found in places of intermediate moisture and *E. pallescens*, an octoploid, was a complete xerophyte. Similar observations were made repeatedly on other species, indicating that the types most suited to rigorous climatic conditions are polyploids.
The polyploids differ from the basal forms in being usually larger (although occasionally the reverse is true), and in their increased vitality or resistance to drought and unfavourable conditions generally ; this brings about a change in ecological distribution, i.e. the geographical limits of the species ; the genetic possibilities of the plant are greatly enhanced.
Analogous observations have been made in regions of intense cold and it seems reasonable to suppose that the polyploidy has been directly occasioned by the temperature extremes, such effects having frequently been induced artificially. The plants are subjected in these regions to temperatures more extreme than those used in the laboratory to induce polyploidy. The ploypoids survive on account of their greater adaptability.

382. GOODSPEED, T. H. 576.312.36
Die Bedeutung von quantitativen Chromosomenveränderungen. (**The importance of quantitative chromosome alteration.**)
Naturwissenschaften 1931 : **19** : 476–83.
The very direct relationship which recent cytogenetic researches have established between the chromosome constitution and the phenotype are illustrated with reference to various cases in *Nicotiana*—amphidiploids ; the so-called " sesquidiploids " ; various heteroploid plants which lead to new types by non-conjunction, non-disjunction, etc. ; chromosomal interchange resulting in rings, chains, etc. ; deletion and many other irregularities following the use of X-rays.
The endless variety of new homozygous types which can segregate from these abnormal individuals is indicated. It is almost impossible not to conclude that some sort of similar series of processes has been concerned in the evolution of the species of the present day.

383. LAWRENCE, W. J. C. 576.356.7
The secondary association of chromosomes.
Cytologia 1931 : **2** : 352–84.
The phenomenon of secondary pairing is described, in which the chromosomes shew no tendency to associate in any way but as bivalents until the metaphase when the bivalents begin to associate into groups of two or three. This association is maintained at anaphase. In consequence of its late appearance it has no effect on segregation. When bivalents are dissimilar in size or configuration, those bivalents which are associated are of similar type.

This secondary pairing is an indication of homology between the chromosomes, not sufficiently great however to lead to chiasma formation.
The behaviour in this respect of various *Dahlia* species is described and a number of references to the phenomenon in the literature are quoted. The homology of chromosomes which shew secondary pairing in diploid apples is proved in the triploids when these chromosomes associate primarily along part of their length. Similar association has been observed between univalent chromosomes in haploids and interspecific hybrids in which no true pairing occurs. A random distribution of pairs of univalents and a separation of the components to different poles has been observed amongst the univalents of triploid species of *Pyrus*.
The author concludes from this survey of the literature that secondary polyploidy as illustrated in the Pomoideae is met with in quite a number of species of cultivated plants. Evidence from secondary chromosome pairing indicates that *Oryza sativa* is a secondary polyploid from a form with seven chromosome pairs. It seems probable that the absence of forms with the lower numbers in a number of such genera supposed to be polyploid is an indication of the higher vigour or adaptability of the polyploid forms. The complicated genetic behaviour of most of these species is also an indication of polyploidy.

384. Müntzing, A. 576.356.7
De empiriska förutsättningarna för förädling genom kromosomökning. (**The empirical assumptions for improvement by chromosome increase.**)
Nord. JordbrForskn. 1931 : **13** : 241–60.
A lecture, giving a general account of polyploidy and its past and present value for crop breeding.

BOTANY 581

385. East, E. M. 581.162.5:575.11
Studies on self-sterility. IX. The behaviour of crosses between self-sterile and self-fertile plants.
Genetics 1932 : **17** : 175–202.
Nicotiana Langsdorffii contains a fertility factor Sf, producing rapid pollen-tube growth in all combinations, which is allelomorphic to the sterility factors found in *N. Sanderae*. When *N. Sanderae* (self-sterile) is reciprocally crossed with *N. Langsdorffii* (self-fertile) the F_1 plants SfSn are self-fertile. Unless they contain modifying factors they are sterile to the pollen of SnSn plants and to the Sn pollen of SnSx plants. SfSn plants when selfed yield F_2 populations of equal numbers of plants belonging to the classes SfSf and SfSn. When crossed with SfSx plants they produce self-fertile and self-sterile plants in the ratio of 3 : 1.
Three modifying factors A_1, A_2 and A_3 are described. They have no effect on S_1 and but very slight action on S_3. A_1 tends to counteract the action of S_2 slightly in incompatible matings ; A_2 tends markedly to counteract the action of S_3 in incompatible matings and appears to have a lethal action on zygotes containing S_1S_3 ; the existence of A_3 which is like A_2 except that it is non-lethal, is rather uncertain.
The derivation of the cytoplasm in the hybrids is shewn to be of great importance, for on it depends whether certain combinations of factors are viable or not ; furthermore it governs the different phenotypic effects produced by certain combinations of factors. The factors for anther colour, pollen colour and green in the corolla react differently to produce different results with *Langsdorffii* cytoplasm and *Sanderae* cytoplasm.

386. Poole, C. F. 581.331.2:575.123
Pollen grain studies as an indication of fertility in hybrids.
Genetics 1932 : **17** : 125–36.
Four species of Crepis were first tested to determine the influence of external factors on fluctuation in percentage of good and bad pollen produced by individual plants and it was found that temperature, and probably other factors, had no appreciable effect. Considerable differences between counts in the first two weeks and next three weeks of flowering were attributed to " physiological adjustments " to flowering and senescence.

The F_3 and F_4 of a *C. rubra* x *C. foetida* amphidiploid were then examined cytologically and it was found that while in general the more fertile hybrids produced higher proportions of good pollen some plants with quite high pollen counts proved completely sterile. Caging the plants seemed to reduce fertility.
The establishment of a correlation between fertility of hybrids and percentage of normal pollen grains is likely to be of value in studies of large hybrid progenies by reducing the amount of cytological preparation.
It is pointed out that irregularity in pollen production may sometimes be due to causes other than hybridity.

DISEASES 632

387. CHRISTENSEN, J. J. 632.451.2:575.1:633.15
Studies on the genetics of *Ustilago zeae*.
Phytopath. Zeits. 1931 : **4** : 129–88.
An elaborate study of the genetics of a number of characters shews the condition to be one of extreme complexity. Monosporidial cultures were normally of two kinds, the fungus was heterothallic. However, rare cases were observed in which a monosporidial culture alone was capable of producing infection. These in many characters resembled the unisexual lines, whilst in certain respects they behaved as the " diploid " phase—in pathogenicity, in their chlamydospore production and segregation for sex, colour and other factors. They were uninucleate and appear to be strictly diploid lines. They retained these characteristics permanently, even after passing through a host. No union of these lines with one another or with unisexual lines was observed.
The sexual relationships between unisexual lines were very complex ; sixty-three mutually incompatible lines were discovered. The most probable explanation of this is the existence of multiple factors but a number of other phenomena which might contribute to the complexity is suggested. Multiple factors apparently determine the segregation of a number of other characters. Reduction division may occur in the first, second or even third division of the fusion nucleus and segregation for cultural characteristics may occur in either the first or second, even one character may segregate in one and others in the other division. These characters segregated independently of one another and of sex.
The cultural characteristics changed very rapidly and frequently by sectoring but the solopathogenic and other sex characters were much more stable.

388. DICKINSON, S. 632.451.2:575.11
The genetics of the smut fungi. (Abst.)
Phytopathology 1932 : **22** : p. 8.
In the covered smut of oats, *Ustilago kollei*, at least seven pairs of cultural characters segregated. The results suggest that colour is occasioned by two, cultural characters by more numerous factors. Meiosis was partly controlled by external conditions.

ECONOMIC PLANTS 633

389. FISCHER, G. 633:575
Pflanzenzucht. **(Plant Breeding.)**
Mitt. deuts. LandwGes. 1931 : **46** : 741–43.
A notice of certain films in which the German seed breeding is illustrated, with the object of extending the use of élite seed.

390. COOK, R. C. 633:608.3
The first plant patent.
J. Hered. 1931 : **22** : 313–19.
Resulting from the recent amendment of the patent laws in the U.S.A. so as to include the products of the breeder, provided they are reproduced asexually, a new rose has been patented. The author in the present article discusses a number of points arising from a consideration of the new law and the first patent in particular, which is an accidental bud sport and not a true product of breeding.

391. Cook, R. C. 633:608.3
Three more plant patents.
J. Hered. 1931 : **22** : 369–72.
Patent No. 2 is the only one of the four which has actually been bred by means of hybridization. The difficulties arising with respect to the patentability of chance mutants is discussed.
Patent No. 4 is the thornless dewberry mentioned in the Journal of Heredity, 1929 : **20** : 567–69.

392. Tedin, O. 633.00.14–1.421
The influence of systematic plot arrangement upon the estimate of error in field experiments.
J. Agric. Res. 1931 : **21** : 191–208.
An experimental study comparing the results of random as opposed to systematic lay-outs. The random lay-out is shewn to be the only one yielding a valid estimate of error.

393. Ssarana, M. 633.1:576.312.32:581.036.5
(The shortening of the chromosomes under the influence of cold in cereals.)
Z. angew. Bot. 1930 : **(5–6)** : 15–22.
By retaining young plants for 24 hours at a temperature of 0°C a marked shortening of the chromosomes was observed. The chromosomes resumed their normal length on being restored to normal temperature. Clear morphological differences could be observed between the chromosomes of different cereals when in such a state.
The influence of cold in producing mutations is under investigation.

394. Åkerman, Å. 633.1–1.411.4:575.1(48.5)
Stråsädesförädling speciellt med hänsyn till våra torvmarker. (**Cereal breeding with special reference to our peat soils.**)
Svenska MosskFören. Tidskr. 1931 : **45** : 189–98.
Early varieties and varieties with short and very stiff straw are the most important requirements for cultivation on peat soils.
Oats are chiefly grown on peat soils and of these the best is Guldregn, which however has very small grains. It was crossed with Seger and the result was Guldregn II which is very nearly the ideal combination of Guldregn's earliness and straw stiffness with Seger's high yield and large grains. On peat soils in South and Central Sweden it produces a 5 per cent higher grain yield than Guldregn I. Other suitable varieties are Stjärn and Arla oats and of black oat varieties Engelbrekt and Argus. Among the early black oats Orion II and Orion C are at present most suitable for peat soils.
Barley also is fairly extensively grown on lime-containing peat soils and Svanhals and Gull are recommended. It is probable that the new, stiff-strawed Danish varieties Opal and Kenia will also be suitable or if specially early varieties are required, Asplunds or Vega.
Breeding experiments have been successful in producing strains of oats from the cross Perle **x** Stjärn which ripen three to four days earlier than the earlier parent and ten days earlier than Guldregn I. Some of the strains from the above mentioned cross were stiffer-strawed than their parents. They have also good, plump grains and are extremely resistant to grey spot and will probably prove a valuable addition to the varieties for cultivation on peat soils.
In barley, a strain has been bred from the cross between Orion II and a very early six-rowed black barley from Norrbotten which is very early and has plump grains and stiff straw. It is also important to breed varieties of winter rye which will withstand freezing and varieties of other cereals resistant to the diseases prevalent on peat soils.

395. Yamasaki, M. 633.1–1.521.6:581.192.6
On the cause of varietal distinctions in certain crop plants in regard to the resistance to the toxic action of potassium chlorate.
J. Nishigahara Imp. Agric. Expt. Sta., Tokyo 1931 : **1** : 305–26.
Experiments suggest that the presence of reducing substances, such as glucose and aldehydes in the cells, cause the reduction of the ClO_3 ion to ClO and the subsequent toxic effect.

396. PAVLOV, K. 633.1–2.112:581.49
633.1–2.112:576.341

Výsledky pokusů o počtu, velikosti průduchů a ssaci sile (osmotické hodnotě) jako pomůckách k zjištěni fysiologických vlastnosti zušlechtěnych sort pšenice a ovsa se zvláštnim zřetelem ku resistenci vůči suchu. (**Results of investigations on the number, size of stomata and osmotic pressure as an aid in the determination of the physiological properties of wheat and oat varieties produced by the breeder, with particular reference to their resistance to drought.**)

Sbornik (Annals) Ceskoslov. Akad. Zemed. 1931 : **6** : 565–616.

Examinations of a number of varieties of winter and spring wheats and of oats shewed that considerable differences exist both in the number and the length of the stomata of the same variety at different periods of growth, the number gradually rising and the length decreasing. The most reliable judgment of the characters of the stomata could be made at the stage of tillering. The varieties having the highest and lowest stomatal length and those having the greatest and least number in the present study are given. In general the more drought resistant and early varieties of winter wheat were characterized by small stomata and vice versa, but no such rule was apparent in the case of spring wheat and oats. No relationship was found between the number of stomata and these characters.

The varieties having the highest and lowest osmotic values for the germinating seed are also indicated, from which it is clear that the drought resistant varieties have higher values than the susceptible varieties, this being particularly clear in the case of winter wheat, with one exception in the variety Ideal. There was also a tendency for the earlier varieties to have higher osmotic pressure than the later ones.

Short stomata are not invariably associated with high osmotic values.

The author points out that these relationships are not absolute but serve as very useful aids in the judgment of the physiological nature of a plant.

397. STAKMAN, E. C. ET AL. 633.1–2.452:576.16:575.12

Physiologic forms of *Puccinia graminis* produced on barberries in nature. (Abst.)

Phytopathology 1932 : **22** : p. 25.

A number of forms have been isolated from aecia occurring on the barberry in nature, indicating the prevalence of hybridization and the consequent origin of new forms in nature.

398. CRESCINI, F. 633.11:575"793"

Sul comportamento del carattere precocità in F_2 da incroci di *Tr. vulgare* (Vill.). (**On the behaviour of the character "earliness" in the F_2 of crosses of *T. vulgare* (Vill.).**)

Riv. Biol. 1930 : **12** : 193–206.

Earlier workers had found earliness to be either intermediate or dominant in the progeny of crosses of *T. vulgare*. For the present experiments pure lines of four varieties were chosen, Florence 193, Cologna 31, Marzuolo 87 and Coronation 95, arranged in a decreasing order of earliness and the crosses made were, 31 x 87, 193 x 31, 193 x 87 and 193 x 95.

No special observations were made in F_1 except that the character concerned was not recessive. The F_2 progeny of the cross 31 x 87 was almost completely dominant to the later parent and segregated in a clear 3 : 1 ratio. The curve of variability of the F_2 of 193 x 31 was clearly bimodal, with an incomplete dominance to 31. The curve for the F_2 of 193 x 87 was also bimodal but intermediate between the parents. The F_2 of 193 x 95 was also intermediate and shewed a marked transgression to the later parent. For an explanation of the facts obtained a detailed analysis of F_3 is required.

399. Crescini, F. and Piergentili, G. 633.11:575.1:581.46
Intorno alla natura genotipica dei caratteri " spiga aristata e spiga semi-aristata " in *Tr. vulgare* (Vill.). **[On the genotypical nature of the characters awned and semi-awned in *T. vulgare* (Vill.).]**
Riv. Biol. 1930 : **12** : 266–72.
The Howards found two factors for the production of awns, one, however, was more effective than the other. To test this theory further three pure lines, 96 semi-awned but the awns long and the ear compact, 48 semi-awned but the awns short and the ear lax and 201 awned with a lax ear. Three crosses, 48 x 96, 201 x 48 and 201 x 96 were made. Only 201 x 48 gave results approaching a two factor segregation. 201 x 96 shewed a segregation indicating the presence of three factors and the cross 48 x 96 gave indefinite results.

400. Florell, V. H. 633.11:575.11
A study of certain characters in wheat back crosses.
J. Agric. Res. 1931 : **43** : 475–98.
The inheritance of compact and lax spike, glume colour, dwarfness and earliness was studied in crosses and backcrosses between two varieties of *T. compactum* and two of *T. vulgare*. Backcrossing is regarded as supplementing the usual method for genetical analysis. Monohybrid ratios were found for spike density, the compact type being dominant. Minor factors were indicated but not determined.
Three factors were found concerned with dwarfness, N for normal and two complementary factors D_1 and D_2, both of which are necessary for dwarfness.
Linkage was indicated between one of the factors for dwarfing and the factor for lax spikes.
Earliness was due to three or more factors.
Glume colour was dependent on a one factor difference.

401. Stewart, G. 633.11:575.11
Inheritance in a wheat cross between Ridit and a segregate of Federation x Sevier (14-85).
J. Amer. Soc. Agron. 1931 : **23** : 964–76.
In the F_1 bronze glumes and red grains were dominant, density and awns intermediate. F_2 ratios of 1 : 2 : 1 were obtained for glume colour, awns, density ; a 7 : 4 : 4 : 1 ratio for grain colour.
No clear segregation occurred for length of culm but a 15 : 1 ratio was suggested for spring : winter growth habit.
In the case of density a significant transgression was observed in both directions.
There was no significant correlation between density and culm length.

402. 633.11:575.127
(Examination of F_1 natural hybrids between *Aegilops cylindrica* Host. and *Triticum*.)
Z. angew. Bot. 1930 : **(5–6)** : 61–64.
The morphological features of the plant and the reduction division are described. There were considerable irregularities, which are thought to be the reason of the complete sterility of the hybrid.

403. Miczyński, K. 633.11*Aegilops*:575.127.2
Studja genetyczne nad rodzajem *Aegilops*, II. Morfologja i cytologja mieszańców międzygatunkowych. **(Genetic studies in the genus *Aegilops*, II. The morphology and cytology of the interspecific hybrids.)**
Rocz. Nauk. Rol. (Polish Agric. and For. Ann.) 1932 : **27** : 1–64.
This is the Polish version of the work referred to in " Plant Breeding Abstracts " Vol. II, Abst. No. 222.

404. DARLINGTON, C. D. 633.11:575.127.2:576.356.7
The analysis of chromosome pairing in *Triticum* hybrids.
Cytologia 1931 : **3** : 21–25.

The author regards the number of chiasmata as an index of the homology between the chromosome pairing. It is claimed that this gives a more accurate indication of the length of chromosomes paired. Observations were made on wheat species, which shewed that the number of chiasmata may vary from one to three. In the hybrid between *Triticum turgidum* and *T. dicoccum* the number is less, although pairing is complete.
Occasional quadrivalents or trivalents and univalents were observed, shewing that pairing between chromosomes derived from the same parent had occurred.

405. PLOTNIKOWA, T. W. 633.11:575.127.2:633.14:576.3
Zytologische Untersuchung der Weizen-Roggen-Bastarde.. I. Anormale Kernteilung in somatischen Zellen. (**A cytological investigation of wheat-rye hybrids. I. Abnormal nuclear division in somatic cells.**)
Planta : Arch. wiss. Bot. 1932 : **16** : 174–77.

In the late anaphase or early telophase of mitosis in root tip cells of wheat-rye hybrids of the fifth or sixth generation, certain abnormalities were occasionally observed. These were either lagging chromosomes or some of the chromosomes were drawn out between the two masses of nuclear material.
The percentage of abnormal mitoses varied from 0–33 in the plants studied.
Only once, in a plant with 46 2n chromosomes, a tetraploid cell with 92 chromosomes was observed.

406. VIALA, P. and LEFÈVRE, J. 633.11:575.183
Sur un cas d'hérédité unilatérale présenté par le blé. (**A case of unilateral inheritance in wheat.**)
C. R. Acad. Agric. Fr. 1932 : **18** : 190–93.

On fertilizing an awnless hybrid K_3 with an awned variety Rieti, seventeen of the F_1 plants were intermediate but one plant in all characters resembled the male parent and has retained these characters during three generations.
Other cases of such male inheritance are quoted but it is pointed out that these are usually cases of hybridization between widely divergent species.
The cross has been repeated but no further case of paternal inheritance has been observed. The hybrid in question has also been crossed with K_3 and has given progeny in no way differing from that of the cross K_3 x Rieti.

407. DELAUNAY, L. 633.11:575.243:537.531
(**X-ray mutations in wheat.**)
Z. angew. Bot. 1930 : (**5–6**) : 5–14.

Descriptions are given of an awned mutant, a speltoid, a monosomic and a complicated speltoid—agropyroid form, all of which appeared in the X-ray progeny of an awnless *vulgare* wheat. Squarehead, forms with branched ears, dwarf forms and complicated polysomics were also observed. Factor mutations as well as chromosome aberrations occurred. The progenies of the latter frequently contained further entirely new, unexpected forms.

408. SCHRÖDER, E. 633.11:576.16:581.46
Anatomische Untersuchungen an den Spindeln der *Triticum*– und *Aegilops*–Arten zur Gewinnung neuer Gesichtspunkte für die Abstammung und Systematik der *Triticum*–Arten. (**Anatomical investigations on the ears of *Triticum* and *Aegilops* species to obtain new points of view on the origin and systematics of Triticum species.**)
Beih. bot. Zbl. 1931 : **68** : 333–403.

The question of the relationships and origin of the different wheat species is discussed from a historical point of view, with special reference to *T. Spelta*.
The nature of the break in the spikelets of the brittle-eared varieties was studied in elaborate detail, in particular the change in type on passing from the lowest to the uppermost spikelets

of the ear. These observations disclosed a close similarity between *T. aegilopoides* and *T. dicoccum* (*T. dicoccoides*) but the morphology was such as to make the latter a little less brittle than the former. *T. durum* shews clear differences in the position of the vascular bundles and of the zone of small cells. *T. turgidum* is very similar to *T. durum* but *T. polonicum* distinctly less so. *T. vulgare* is clearly different again. The type of break characteristic of *T. Spelta* is then described. *T. aegilopoides* is said to have the anatomical features which condition this break as well as those conditioning the emmer type.

Examples of the various groups of the genus *Aegilops* were examined on similar lines. *Ae. speltoides* proved similar to *T. durum* in the form of the break but the anatomy was such as to produce only an occasional break of the individual spikelets and this of the spelt type. *Ae. sharonensis* and other species of the section *Platystachys* also had tendencies towards both types of breakage. *Ae. ventricosa* and *Ae. squarrosa* (*Pachystachys*) displayed the spelt type of morphology, *Ae. cylindrica* the lower rudimentary spikelets were of the emmer and the remaining spikelets of the spelt type. *Ae. caudata* in the section *Macrathera* has both types, the other two species, *uniaristata* and *comosa*, resemble much more certain species of the section *Pleionathera*, which break only in the lower spikelets, causing the whole ear to fall ; this break occurs in the emmer way. The other members of the latter section break similarly in the lower part of the ear and in the spelt way higher up.

The observations disclosed a great uniformity in the *monococcum* group. *T. aegilopoides* is considered the most primitive form, having led directly or indirectly to *T. dicoccoides*. The species comprising the emmer group take up the following order : *T. dicoccoides—T. dicoccum. T. durum—T. turgidum.* A very clear distinction is evident between this group and the *vulgare* group, *T. vulgare* and *T. Spelta* being morphologically very similar. There is no support for the supposal that the latter has arisen in recent times from the former. *T. vulgare* is regarded as having originated from *T. Spelta*, independently of the emmer group.

The author is led by a consideration of the results of these observations to regard *Ae. sharonensis* as the most primitive form and *Ae. ovata* is regarded as a separate phylum from a primitive ancestor, leading through *cylindrica* and *ventricosa* to *T. Spelta* and *vulgare* ; the grounds for this are mainly the close relationship between spelt and *Aegilops*. He regards spelt as having originated from a brittle *Aegilops* of the *ovata* or *ventricosa* type.

Possible relationships for other wheat species and for speltoids are suggested on the same grounds.

409. Reichert, F. and Paulsen, E. 633.11:581.192

Sobre una posible diferencia de los trigos de pedigree basada en la variación de la composición química de los jugos de presión y de los compuestos de cenizas de las plantas, en diferentes fases vegetativas. (**A possible difference in pedigree wheats, based on the variation of the chemical composition of the expressed sap and of the ash components of the plants, in different phases of growth.**)

Rev. Fac. Agron. Veterinaria B. Aires 1931 : **7** : 329–44.

The chemical composition of the juices expressed from the plants at various times from germination to maturity was characteristic for the different individuals examined, and it is thought probable that further study might reveal an association between such differences and the baking quality of respective varieties.

410. Yamasaki, M. 633.11–1.521.6:581.192.6
633.16–1.521.6:581.192.6
633.18–1.521.6:581.192.6

Testing of the resistance of varieties of certain crop plants to the toxic action of potassium chlorate with seeds and young seedlings.

J. Nishigahara Imp. Agric. Expt. Sta., Tokyo 1931 : **1** : 287–304.

The seeds were either soaked for a certain time in solutions of $KClO_3$ of varying concentration and the young seedlings were grown for a short time in similar solutions. The degree of injury could be correlated to a certain extent with the degree of resistance to drought and cold. Thus, in wheat and barley resistance to $KClO_3$ was correlated with susceptibility to cold, in rice such resistance was correlated with resistance to drought.

411. GORLATSCH, A. A. 633.11–2.111–1.521.6:575.115
(The inheritance of cold resistance of different winter wheat varieties.)
Bull. Belaya Tserkov Plant–Breed. Sta. 1930 : 5 : 3–28.

The uncommonly low temperatures prevailing in the spring of 1929 gave an opportunity of judging the winterhardiness of the varieties in the nursery. The most hardy varieties proved to be deficient in yield compared with less hardy varieties of the Western European type.

Plants were counted as perished when they did not resume growth in the spring and as survived when growth was resumed, even though some of the leaves had been damaged. The variation caused by differences in thickness of the snow-covering in different parts of the plots was very evident.

The first combination of a susceptible female with a resistant male, shewed a complete survival of the ♂ and F_1, the ♀ survivals varying from 100 per cent to 10 per cent. Hardiness was therefore fully dominant.

Leaves are known to be more susceptible to cold than shoots and the plants whose leaves suffered but which resumed growth in spring are thought to be plants shewing the first stages of damage, intermediate in other words between the sound and the perished.

Another combination shewed dominance of resistance in all but one hybrid plant which perished where the resistant male parent did not ; in another the female parent perished entirely, the male was perfectly sound and the hybrid lost its leaves but resumed growth in the spring in the majority of plants ; thus a consideration of some of these plants would indicate full dominance of resistance but of the other plants intermediate inheritance. Certain other combinations shewed complete intermediacy of the hybrids. In other combinations, certain sections shewed no difference between the hybrids and either parent ; in other sections of the same combination the hybrid was intermediate and in still other sections the hybrid perished with the susceptible parent, as if resistance were recessive. In still other combinations resistance was entirely recessive. The precise type of inheritance was different for each particular combination.

It is pointed out that when the hybrid is intermediate in resistance between the two parents, then the appearance of dominance or recessiveness depends entirely on the temperature to which the cultures are subjected. Similarly if different parental varieties differ in their degree of resistance the hybrids, if intermediate in each case between the respective parents, will differ in resistance. Hence hybrids of different parental combinations will react differently to the same temperature conditions and so different combinations will have different dominance relationships. To test this point two combinations were compared in which one parent was common and the second parents of the respective crosses were of clearly different reaction. The hybrids from the combination with the more resistant second parent were distinctly more resistant than the hybrids from the other combination in which the second parent was less resistant. The intermediate nature of the F_1 thus seems to be established.

For the same reasons the percentage survival in F_2 was very variable but on the whole it proved to be intermediate between the two parents which were sown side by side with the F_2 for comparison. There were two combinations in which one parent perished entirely and the other survived entirely. In one of these there were 363 dead plants : 134 survivals, in the other 128 : 40. A number of other combinations gave results more or less similar and in all cases the number of survivals was less than the number perished.

The F_4 generation in the majority of cases was largely intermediate, with a small number of plants approaching each of the parents. Only one case of a clear transgression of the parental limit for resistance was observed. The lower parental limits were not transgressed.

412. YAMASAKI, M. 633.11–2.111–1.547.1
On the growth of seedlings in wheat varieties differing in cold resistance.
Proc. Crop. Sci. Soc. Japan 1931 : 3 : 309–18.

Hardy varieties when germinated in the field or the greenhouse in summer excelled non-hardy varieties in rate of growth and under winter conditions the reverse was true. This, it is suggested, may be the reason for differences in sugar content reported by previous authors.

413. KALÉ, G. 633.11–2.112–1.521.6:575.1
Recherches anatomiques, chimiques, physiologiques et génétiques sur *Triticum vulgare* Host. et contribution à l'étude de l'échaudage. **(Anatomical, chemical, physiological and genetical researches on *Triticum vulgare* Host. and a contribution to the study of damage by heat.)**
Th. Doct. Univ. Toulouse 1931 : **8** : 229 pp.
A full study of the nature and effects of this damage. With regard to the inheritance of the character of resistance associated with certain varieties, no clear Mendelian segregation was observed but resistance was undoubtedly recessive.

414. HANNA, W. F. and POPP, W. 633.11–2.451.2:576.16
Physiologic forms of loose smut of wheat. (Abst.)
Phytopathology 1932 : **22** : p. 11.
Two distinct forms have been observed, to one of which the *durums* are susceptible and the *vulgares* resistant.

415. YU, T. F. and CHEN, H. K. 633.11–2.451.2–1.521.6
A Chinese wheat resistant to flag smut. (Abst.).
Phytopathology 1931 : **21** : 1202–03.
As a result of repeated selection several resistant varieties have been established and one, Nanking No. 716, appears to be immune.

416. FEUCHT., W. 633.11–2.451.3–1.521.6
Die Wirkung des Steinbrandes *Tilletia tritici* (Bjerkander) Winter und *Tilletia foetens* (Berkeley et Curtis) Tulasne auf verschiedene Winterweizensorten bei künstlicher Infektion in ihrer Abhängigkeit von äusseren Faktoren. **(The effect of smut *Tilletia tritici* (Bjerkander) Winter and *Tilletia foetens* (Berkeley et Curtis) Tulasne on various varieties of winter wheat by artificial infection and its dependence on external factors.)**
Phytopath. Zeits. 1932 : **4** : 247–90.
A study of the effect of temperature of the air and of the soil on the seed when sown, and its relation to smut infection, indicated that moderately low temperatures not only on the day of sowing but of some days following, tended to increase the amount of infection. The varieties varied in reaction. Low temperatures were unfavourable to infection.
From experiments on the effect of moisture in the soil, it appeared that dryness most favoured infection.
Calcium cyanamide, used as a disinfectant, reduced the amount of infection to a certain extent but its use is not recommended.
Experiments on the effect of the previous crop in rotation on smut infection shewed that this was much heavier after peas than after wheat.
The results of experiments in different parts of the world on varieties of wheat shew that the immunity of a variety in one place does not necessarily mean immunity in another.
A number of varieties of winter wheat were tested for resistance to smut by artificial infection with *Tilletia tritici*. Of the German varieties tested only Heils Dickkopf and Hohenheimer No. 77 were highly resistant. Of the five American varieties used, only Kharkof 112 was markedly attacked.
The smutted ears of a number of winter wheat varieties were carefully investigated and 98–98·5 per cent of the spores were *Tilletia tritici*, 1·5—20 per cent *Tilletia foetens*. This is the first record of the occurrence of the latter smut in this district.
The virulence of strains of *Tilletia tritici* from different parts of Germany was tested on the resistant wheats. One strain in particular proved extremely virulent, even the usually highly resistant Hohenheimer 77 was 36·5 per cent attacked.
As differences were noted in resistance between the original Heils Dickkopf and the later selections an extensive series of experiments was undertaken which shewed that susceptibility to *Tilletia tritici* was greater in the later selections than in the original strain except in the case of the very virulent Cosel strain of smut.

417. KIESSELBACH, T. A. and ANDERSON, A. 633.11–2.451.3–1.521.6:575

Breeding winter wheat for resistance to stinking smut. (***Tilletia levis* and *Tilletia tritici*.**)

Res. Bull. Nebr. Agric. Expt. Sta. **1930** : **51** : 22 pp.

A number of varieties were tested with smut from seventeen different sources and the results given. Certain selections from Turkey were very resistant and frequently remained free from both smuts.

The resistant selections were tested with regard to stem rust (four forms), cold resistance, yield and certain other agronomic characters and were found to compare favourably with the standard variety, exceeding Nebraska 60 in yield and earliness and equalling it in cold resistance.

Certain promising hybrids were also observed.

418. PAINTER, R. H., SALMON, S. C. and PARKER, J. H. 633.11–2.7–1.521.6:575

Resistance of varieties of winter wheat to Hessian fly, (***Phytophaga destructor*) (Say).**

Tech. Bull. Kans. Agric. Expt. Sta. 1931 : **27** : 58 pp.

The methods of testing the varieties are described in detail. The tests of about 400 varieties, selections and hybrids shewed that marked differences in resistance exist, one group of highly resistant strains being revealed. Many varieties, although homozygous for agronomic characters were still segregating for resistance. Results for different years and different intensities of infestation, in the field and in the greenhouse, were in agreement.

A description of a number of the varieties in the respective resistance groups is given. It is notable that all the resistant varieties are soft wheats or are descended from a soft wheat and the highly susceptible varieties were nearly all hard wheats. In the segregates from crossing these types, however, recombinations did occur. There is also a suggestion of an association of purple straw and resistance.

In crosses between resistant and susceptible varieties there was clear evidence of segregation and the absence of close linkage between resistance and important agronomic characters. F_1 tests shewed that susceptibility was dominant or partially so. The fact that two varieties which shew the same reaction to one strain of the fly behave differently to another gives evidence of the existence of more than one factor conditioning resistance. Certain hybrids have been obtained in which resistance is combined with very stiff straw.

A form of partial resistance or tolerance, of possible economic value, is described.

Clear evidence is given of the existence of numerous biological strains of the fly in addition to the one used in these experiments.

419. FERENC, K. and LAJOS, P. 633.11:644.641.016

Az 1930. évi búzalisztek minösége. A búzalisztek sütőipari minőségének megállapitására használatos modszerek vizsgálata. (**Quality of wheat flour in 1930. Investigation on the method of determining the baking quality of wheat flours.**)

Mezőgazdasági Kutatások 1931 : **4** : 311–40.

Comparisons were made with a number of doughs of varying qualities between the results of actual baking tests and the figures for protein content, water absorption and quantity of gluten. There was no correlation with any of these but when the quantity and quality of the gluten were given equal values and combined, a good agreement was obtained with the results of the baking tests.

420. ÅKERMAN, Å. 633.11:664.641.016:575.1
Om möjligheten att genom förädling uppdraga vetesorter med bättre kvalitet. (**On the possibility of breeding varieties of wheat with better quality.**)
Sverig. Utsädesfören. Tidskr. 1931 : **41** : 347–59.
Lecture at the Miller's Conference at Svalöf 31/7/1931.
The cultivation of spring wheats has much increased recently and of the varieties grown Extra-Kolben II and Rubin, especially the former, are foremost with regard to baking quality.
Two groups of factors are necessary for a good baking capacity, viz. a capacity for fermentation and the quality and quantity of the gluten.
Breeding work has been done with winter wheat with special regard to baking quality and Svea II from a cross between Thulevete II and an indigenous wheat (Sammet) from Central Sweden is the result—Svea II has as good a yield as Thule II and good baking quality. Its only drawback is a low hectolitre weight. Other good varieties are Ankar and Stål wheat. Ankar wheat was bred from the cross between Bore and Iduna wheat and has a relatively good baking capacity.
Stål wheat, from the cross Sol x Pansar is grouped with Ankar and Svea II among the good baking wheats on account of its high gluten content.

421. E. B. 633.13(47.1)
633.14(47.1)
Kvaliteten hos råg och havren i vårt land. (**The quality of rye and oats in this country.**)
Tidskr. Finl. Svenska Lantm. 1932 : **14** : 54–56.
A comparison between the indigenous varieties and some cultivated in other countries.

422. *LEBEDEFF, V. N. 633.13:575.11:581.48
(**Factorial analysis of characters of distinction between hulled and hull-less varieties of oats.**)
Bull. Belaya Tserkov. Plant–Breed. Sta. 1930 : **5** : Par. 3.
The F_1 of crosses of hulled and hull-less varieties contained not only intermediate types but also hulled and hull-less. In some combinations the hulled types predominated, in others the opposite type. In the cases of predominance of the hulled type the number of florets was low and in the reverse case there were as many as seven, a number exceeding that of the naked parent. The F_2 shewed segregation into very diverse types which were arranged in six classes, the first class being fully hulled and identical with the husked parent, the sixth class quite or almost naked. Numbers were not sufficiently large to give altogether reliable ratios but the figures for a large number of combinations are given. Considering the four combinations which contained more than fifty individuals, the number of fully husked individuals represented about $\frac{1}{4}$ of the whole, which is evidence for monohybrid segregation.
In several crosses, however, there was a considerable deficiency in the naked group, leading the author to conclude that one or more subsidiary genes are operative, causing partial husk or the occurrence of isolated husked grains in the panicle. The various combinations fall clearly into three groups, in which the number of naked plants corresponded with a mono–, di– and tri–hybrid ratio. Two combinations gave no naked segregates and it is possible that more than three factors are present.
The totals for all crosses shewing a dihybrid segregation and several of the individual crosses, conform closely to the expected results on the author's assumption. Certain cases of deficiency of fully husked plants led to the assumption that the basal gene was not fully epistatic to the subsidiary genes when these were in the double recessive condition. Certain excesses of husked plants were interpreted as errors in classification.

*** A full summary of this paper is on file at the Bureau.**

423. WEXELSEN, H. 633.13:581.162.32
Naturlig kryssning i havre. **(Natural crossing in oats.)**
Nord. JordbrForskn. 1931 : **13** : 291–301.
Black-grained plants were found among the selected white-grained progeny of crosses between black and white oats to the extent of 5·86 per cent and were the result of natural crossing.
In an experiment in which black and white oats were sown in alternate rows, the amount of crossing from black to white was 0·25 per cent in 1929 and 0·026 per cent in 1930. Any chance of natural crossing should be avoided therefore in more critical investigations.

424. COFFMAN, F. A. ET AL. 633.13–2.451.2–1.521.6:575.1
Inheritance of resistance in oats to *Ustilago levis*.
J. Agric. Res. 1931 : **43** : 1085–99.
A large number of individuals from crosses of Markton with a number of susceptible parents was tested by artificial inoculation after removal of the husks in the F_3 generation. Clear-cut Mendelian ratios were not evident but in the majority of crosses the number of resistant families was greater than the number of susceptible ; the two cases in which this was not so were families of very small numbers and on the whole the data seem to indicate that resistance to the physiological form used is governed by one factor.
Certain F_3 families were carried on to F_4 and the correlation between infection in F_3 and F_4 determined. Significant correlations were observed, especially in the case where the F_4 was grown from an F_3 family which had not been infected. Transgression for susceptibility was observed in some F_4's, the infection percentage being higher than in the corresponding F_3 and plants more susceptible than the susceptible parent being observed.
No correlation was detected between resistance and any of the morphological characters examined.

425. REED, G. M. 633.13–2.451.3–1.521.6:575.1
Inheritance of smut resistance in hybrids of Early Gothland and Monarch oats.
Amer. J. Bot. 1931 : **18** : 803–15.
Early Gothland with a high degree of susceptibility to loose smut is also very resistant to covered smut. Monarch is resistant to loose smut but completely susceptible to covered smut. These two varieties were crossed and of the F_2 progeny some were inoculated with loose smut, some with covered smut and some were uninoculated. 18 per cent of the plants inoculated with loose smut were infected and 10·4 per cent of those inoculated with covered smut.
The F_3 progeny was similarly treated and a detailed analysis is given of their behaviour. An F_4 was also grown. The results shew that resistance to loose smut is inherited independently of resistance to covered smut. Progenies resistant to covered smut may be resistant, segregating or susceptible to loose smut and a similar relation was found with regard to loose smut. Some progenies were resistant to both smuts.
The dark glume colour of Monarch appeared to be inherited as a single factor and there was no evidence of correlation between the colour of the glumes and susceptibility to either smut.

426. CRÉPIN, C. 633.14:575.12
L'amélioration du seigle. **(Improvement of rye.)**
J. Agric. Prat. Paris 1931 : **56** : 230–32.
Local rye was compared, by Student's method applied to the results of comparative plots, with a mixture of the local with Petkus rye. The mixture proved 15 per cent more productive and more resistant to lodging.
In later cultures of this mixture a large proportion of hybrids could be detected. The mixed population proved superior also to the pure Petkus.

427. NICOLAISEN, W. 633.14:575.182 –18
635.656:575.182 –18
Ueber quantitative Xenien bei Roggen und Erbsen. (Quantitative xenia in rye and peas.)
Z. Züchtung 1932 : A. **17** : 265–76.

The cross was between Wageningen rye with yellow grain colour and Petkuser rye with green grain colour which is known to be dominant. The grains of the Wageningen rye were separated according to colour and the difference in size calculated. In every case the green grains were larger than the yellow but did not reach the size of the grains of the green Petkuser parent. The results may have a practical significance for increasing grain weight.

In peas, experiments shewed that the percentage of cross-fertilized seeds when the flowers had not been emasculated was only slightly less than when emasculation had been performed.

The results of all the crosses, using the large seeded variety Mahndorfer Viktoria as the male parent, shewed a marked increase in seed weight up to 81·4 per cent. If a small seeded variety had been used as the female parent, the seeds were not as large as those of the male parent but in crosses between two large seeded varieties, the seeds were larger than those of the parents. The possible causes of this observed increase in seed weight are discussed.

428. MANGELSDORF, P. C. and REEVES, R. G. 633.15:575.127
Hybridization of maize, *Tripsacum* and *Euchlaena*.
J. Hered. 1931 : **22** : 329–43.

In crosses between *Tripsacum* and *Euchlaena* cases of parthenogenetic development of both the male and female gametes have been reported by other writers and the author calls attention to the possibility of attaining homozygosity in maize by similar means. The probability of procuring an individual combining all favourable genes is enormously enhanced compared with the ordinary methods of cross-breeding.

Attempts in this direction have so far failed but hybrids have been produced between maize and *Tripsacum*. The cross was only accomplished after shortening the maize silks in order to reduce the distance to be traversed by the *Tripsacum* pollen tubes. Various abnormalities of the hybrid seeds are indicated.

When the hybrid seeds are adjacent to pure maize, seeds produced by pollination with maize pollen, they develop more successfully than when only hybrid seeds are present. The maize seeds are thought to be capable of stimulating the flow of nutritive materials in a way that the hybrid seeds are not.

Chromosome counts gave no indication whatever of parthenogenesis having occurred.

The hybrid seeds are extremely light in weight and only a very small proportion of them germinated. This varied with the maize variety used and with the *Tripsacum* type, the Connecticut type with the higher chromosome number crossing more readily. Plants could only be obtained from most seeds by a special method of germinating them in agar, which is described.

The hybrids resemble the pollen parent, *Tripsacum*, more than maize, this being more marked in the case of the Connecticut *Tripsacum* with 36 haploid chromosomes than the Texas form with 18.

The former hybrids appear to be completely sterile and in meiosis have 18 bivalents and 10 lagging univalents. This seems to be a case of autosyndesis. The other hybrid has not yet been examined.

The reciprocal cross has so far failed. Annual teosinte, if its silks are shortened, can be successfully crossed by both *Tripsacums* but no mature seeds have yet been obtained.

429. MANGELSDORF, P. C. 633.15:576.116.1
Modification of Mendelian ratios in maize by mechanical separation of gametes.
Proc. Nat. Acad. Sci. 1931 : **17** : 698–700.

A gene is described which causes a reduction in size of the pollen grains. It is linked with starchy endosperm, both being in the third chromosome and in consequence in crosses with sugary plants all normal pollen grains of the heterozygotes are sugary with the exception of the

cross-overs. The small grains do not function in competition with the normals and the percentage of starchy seeds in the back-cross is a direct measure of the crossing over.
Confirmation of these assumptions was gained by artificially separating the pollen grains into different sizes, which produced marked differences in the ratios of starchy to sugary.

430. CHANCE, H. L. 633.15:577.15
The relation between catalase activity and vigor in inbred strains and crosses of corn seedlings.
Amer. J. Bot. 1931 : **18** : 696–703.
No correlation was observed between catalase activity and vigour of the seedlings. The catalase activity of inbred strains and the crosses between them was fairly constant but there seemed to be no connection between the activity of the inbred strains and that of their hybrid.

431. JOHNSON, I. J. and HAYES, H. K. 633.15:581.162.32
A comparison of hand and wind pollination in making F_1 crosses between inbred lines of corn.
J. Amer. Soc. Agron. 1932 : **24** : 85–90.
With the use of isolated plots in which the male parent is detasseled and the plants are wind pollinated, the cost of labour is considerably reduced compared with that for hand pollination on a large scale.

432. RHOADES, M. M. 633.15:581.162.5:576.356.1
Linkage values in an interchange complex in *Zea*.
Proc. Nat. Acad. Sci. 1931 : **17** : 694–98.
A new case of semi-sterility, semi-sterile–4, is reported. It is again a result of a segmental interchange in the *b–lg* and the *pr–v_2* chromosomes. Semi-sterile plants possessed a ring of four chromosomes. When it was crossed with plants trisomic for either of the two chromosomes involved, the resulting twenty-one chromosome plants shewed chains of five chromosomes and crossing it with semi-sterile–1 resulted in plants having a ring of six chromosomes, the b–lg chromosome being common to both these cases of segmental interchange.
The data shew that crossing-over in plants with the interchange is of the same order as in normal plants.
The point of the interchange was located by crossing over percentages of the point with various genes in the chromosome.

433. MOORE, M. B. 633.15–2.451.2:575.1
The genetics of *Ustilago zeae*.
Phytopathology 1932 : **22** : p. 20.
A study was made of the gametic (F_1) segregates from crosses of monosporidial lines of differing characters. All characters studied, including sex, were governed by multiple factors.

434. SLEUMER, O. H. 633.15–2.451.2:577.8
Ueber Sexualität und Zytologie von *Ustilago Zeae* (Beckm.) Unger. **[Sexuality and cytology of *Ustilago Zeae* (Beckm.) Unger.]**
Z. Bot. 1932 : **25** : 209–63.
The occurrence of heterothallism is demonstrated, together with the existence of more than two sexes. The conjugation processes are described and figured, also the nuclear behaviour. Cells with one, two and more nuclei were observed in the mycelium, the former gradually tending to predominate in the later stages.
Five groups differing in their behaviour were observed ; group 1 gave infection in presence of group 2 or 4, group 5 gave infection in presence of group 3 and 4. The strains in group 3 were later seen to be not identical and a sixth group had therefore to be recognized.

435. MARSTON, A. R. 633.15–2.7–1.521.6:575
Breeding European corn borer resistant corn.
J. Amer. Soc. Agron. 1931 : **23** : 960–64.

A continuation of the work referred to in Plant Breeding Abstracts Vol. I, Abst. No. 360.
F_4 inbred strains of the resistant variety Amargo with local varieties proved to be very little less resistant than the Amargo parent and 20 per cent more resistant than the F_3 inbred lines.
The escape from attack seems to be due to some inherent resistance brought in by the Amargo parent.

436. HUBER, J. A. 633.16:575"791"
Ueber den Wintertypus der Gerste. (**The winter type of barley.**)
Z. Züchtung 1932 : A. **17** : 217–27.

A cross was made between Stadlers two-rowed winter barley and Proskowetz Hanna (spring) barley and the reciprocal. Plants of F_2, F_3, F_4 and F_5 were sown, some in the autumn and some in the spring of the following year. There was segregation into plants which headed at the normal time, those heading later than usual and those which did not head at all when spring sown.
The results led to the assumption of four factors, A, B, C and D for heading, the genetical composition of the parents being aaBBccdd or aabbCCdd for Stadlers two-rowed winter barley and AAbbCCDD or AABBccDD for Proskowetz Hanna spring barley.
True winter barleys are recessive for all four factors for heading while for spring barley at least three factors, A, B, C or D are necessary.
The spring-winter barleys have a special place as they head at the normal time and therefore possess the genetical make-up of true spring barleys but at the same time they are winterhardy and have the same growth habit in the early stages as the winter barleys.
The behaviour of several varieties of winter barleys when spring sown was examined and found to vary considerably, some of them clearly possessing one or, in the spring-winter types, even two or three, factors for heading. A correlation was found between the pubescence on the lowest leaf-sheath and the winter habit of growth. This character segregated in a 3 : 1 ratio with pubescence dominant.

437. NILSSON, H. 633.16:575.242.061.6:581.192
Chemisch-experimentelle Beiträge zur Kenntnis einiger Chlorophyllmutanten der Gerste. (**Experimental chemical notes on certain chlorophyll mutants in barley.**)
Ark. Kemi Min. Geol. 1930 : **10** : A (12) p. 34.

The material segregated into three green : one chlorophyll free. There was no difference in the three types with respect to amylase. The green seedlings required more oxygen than the white but there was no difference between the homozygous and heterozygous greens.

438. HUBER, J. A. 633.16:575.252
Eine atavistische Variation bei der Gerste. (**An atavistic variation in barley.**)
Der Züchter 1932 : **4** : 33–35.

An aberrant plant is described which occurred in the F_2 of the cross *Hordeum distichum nutans* x *H. spontaneum*. The mutant form developed short hairs in various places such as the awns and parts of the glumes where usually only toothing is apparent. Only one out of five ears on the plant was abnormal and the phenomenon is regarded as a bud variation.
The grains from both the abnormal and normal ears gave plants which were fully normal and the abnormality is thus seen to be a periclinal chimaera.
The possibility of regarding this as a reversion to an ancestral hairy type is indicated.

439. GHIMPU, V. 633.16:576.312.32
Cercetări cromozomice asupra speciilor de orz. (**Researches on the chromosomes of species of barley.**)
Bul. Minist. Agric. Domeniilor 1931 : **5/6** : 3–28.
All the cultivated barleys investigated had fourteen 2n chromosomes. Among the wild species, *H. maritimum* and *H. murinum* had fourteen 2n and *H. bulbosum* and *H. secalinum* had twenty-eight 2n chromosomes. The volume of chromatic substance was found to be greater in the cultivated varieties.
Two chromosomes bearing satellites were observed ; these are considered to be nothing more than a portion of the chromosome more deeply constricted off. No special connection was noticed between the satellites and the nucleolus.

440. INOUYE, C. 633.16:576.353
Somatic mitosis in *Hordeum sativum*.
Proc. Crop. Sci. Soc. Japan 1931 : **3** : 319–35.
The course of mitosis as observed in cells of the archesporium, glume and root tip is described and figured. At metaphase fourteen double chromosomes were observed.

441. HARLAN, H. V. 633.16:581.46:575.242
The origin of hooded barley.
J. Hered. 1931 : **22** : 265–72.
A number of remarks on hooded barley, its first occurrence in the last century in Nepal, the morphology and homologies of the awns. A hooded mutant which occurred in the F_2 of a cross of a barley "Everest" from the Himalayas with "Manchuria" is described and the original hooded barley is thought to have arisen in the same way.

442. HONECKER, L. 633.16–2.44–1.521.6:575
Beiträge zum Mehltauproblem bei der Gerste mit besonderer Berücksichtigung der züchterischen Seite. (**Notes on the mildew problem in barley with particular reference to the aspect of breeding.**)
Pflanzenbau Pflanzenschutz u. Pflanzenzucht 1931 : **8** : 78–84, 89–106.
A large number of varieties were tested with *Erysiphe graminis* and their reactions are described. Only one truly resistant variety (Intensiv) was observed and this was the variety which least suffered from drought. This variety first attracted attention because it is characterized by a low protein and high starch content. The variety Intensiv originated as a single plant selection from a land race.
In addition to Intensiv, another variety was infected only slightly in the first leaf. All the remaining of the 163 varieties tested were quite susceptible.
Infections were made of detached leaves in Petri dishes, with the same results.
An examination of 150 plants of Intensiv shewed that whilst many were completely free from infection, some were slightly attacked. Some of these latter plants shewed discrepancies also in awn colour and are ascribed to natural hybridization.
Amongst a number of other varieties belonging to various species of *Hordeum* also tested, certain plants were observed with varying degrees of resistance. Most varieties proved to be impure with regard to resistance.
All the winter barleys tested were susceptible.
The quality of Intensiv being very inferior, hybrids were made between this and other varieties and the reaction of the F_2's studied. These results shew that resistance is recessive. Constant resistant and susceptible forms evidently segregated in F_2 and the proportion of the three classes indicates a monohybrid relationship. The results obtained by field tests were substantiated by artificial infection. In certain F_7 progenies the heterozygotes were visibly less attacked than the pure susceptibles ; in other progenies this clear distinction was not evident, gradations in degree of infection being observed with very few plants in the fully susceptible class, as if multiple factors were at work.

Although the resistant segregates on the score of artificial infection appeared to be fully immune these lines developed a certain number of pustules in the field at the time of maximum development of the mildew. This is thought not to be due to the result of the presence of other physiological forms but to the difference in external conditions. Experiments to test this point shewed that resistance tended to diminish with advancing age of the plant.
Various lines arising out of these crosses combine a general high quality with a high degree of resistance.

443. ZEINER, W. 633.16–2.451.2–1.521.6:575.1
Das Verhalten verschiedener Sommergersten-Kreuzungen hinsichtlich der Anfälligkeit für *Ustilago nuda*. (**The behaviour of a number of summer barley crosses with regard to reaction to *Ustilago nuda*.**)
Z. Züchtung 1932 : A.17 : 229–64.
The infection was carried out with the special apparatus previously described by Piekenbrock. Only spore material collected from the parental varieties was used for infection in each cross.
Parental varieties representing the extremes, full susceptibility and almost immunity, were chosen. The F_3 and F_4 results of this cross are given. Those plants with less than 5 or more than 50 per cent infection were regarded as homozygous and the remainder as intermediate. This arrangement gave a clear 1 : 2 : 1 segregation. There was no clear dominance of either resistance or susceptibility.
The progeny from a cross between two highly susceptible varieties was almost entirely susceptible ; a certain proportion of plants remained free but this was apparently due to failure of infection.
A third cross was examined between a variety of ordinary resistance and a fully resistant variety. For this cross a certain number of F_5 families were also tested. In this case all plants with less than 15 per cent infection were counted as resistant. Again the proportions indicated a 1 : 2 : 1 segregation, with no clear indications of dominance.
A cross between a medium and highly susceptible variety gave indications of transgression towards greater susceptibility.
In addition to these crosses a medium susceptible was crossed with an immune, in which four degrees of infection were recognized, giving proportions very closely corresponding to a dihybrid ratio. The most valuable of the immune segregates came from this cross. There was no close linkage, if any linkage at all, between resistance and naked grain. The resistance of the immune parent was shewn, in crosses with a susceptible variety, to be conditioned by a single factor and crosses with the resistant parents used in earlier crosses shewed that the factor for partial resistance was distinct from these resistance factors.
The only highly resistant varieties were naked 4-rowed types but the promising lines from the 5th cross referred to above shew that such varieties can be used successfully in breeding malting barleys. The yields of these lines were entirely satisfactory.

444. CHRISTENSEN, J. J. and GRAHAM, T. W. 633.16–2.484:576.16
Physiologic specialization in *Helminthosporium gramineum*. (Abst.).
Phytopathology 1932 : **22** : p. 6.
84 monosporous cultures out of 226 obtained from different regions in North America and Germany were distinct. Infections varied very much according to the variety of barley and the race of the pathogen.

445. FINNELL, H. H. 633.174:575:578.08
Methods of improving grain sorghum varieties.
Bull. Panhandle Agric. Expt. Sta. 1930 : **12** : 13 pp.
The value and limitations of various methods of " improvement," including mass selection, pure line breeding and hybridization, are pointed out, with indications of a popular nature on the carrying out of the various processes.

446. CHIAPPELLI, R. 633.18
Nuove varietà di riso. **(New varieties of rice.)**
Giorn. Risicolt. 1931 : **21** : 165–68.

Roma.
Selected from Lady Wright. Resistant to disease and lodging. High yielding and good for export on account of the transparency of the grains after polishing.

Precoce Ardizzone.
Selected from Americano 1600. A semi-fine variety resistant to lodging. Foliage scanty but tillering abundant. Does well in relatively cold water. Ripens ten days earlier than Originario.

Sancio No. 9.
Selected from Precoce Vittoria which it resembles in many respects. Resistant to disease and lodging. Has a high yield.

Cento Giorni.
A very early variety selected from Chinese Originario. It is resistant to lodging. It is not pure but exists in two forms, awned and unawned. Its earliness is such that it can be sown in the beginning of June and harvested at the beginning of October.

447. KOCH, L. 633.18:575(92.2)
Past, present and future in the obtaining and spreading of superior rice varieties in the Dutch East Indies.
Proc. 4th Pacific Sci. Congr. Java, 1930 : **4** : 9–14.

The selected lines in the past proved no superior to the mixed populations. Inbreeding was started in 1922 and after several generations of inbreeding strains outyielding the unselected population by 25 per cent resulted in some strains, other strains even shewed a decrease. Seed of the best strains is mixed for multiplication.
Quite soon systematic hybridization will have to be employed.

448. YAMAGUTI, Y. 633.18:575.061.6
633.18:575.061.1
633.18:575"793"
633.18:575.116.1
Kreuzungsuntersuchungen an Reispflanzen. III. Genetik der Farbeigenschaften verschiedener Pflanzenteile, des Wuchshabitus und der Ausschusszeiten. (Zugleich ein Beitrag zur Kenntnis der Koppelungsgruppe beim Reis). **[Crossing investigations on rice plants. III. Genetics of the colour characters of various parts of the plant, the growth habit and the time of heading. (Together with a contribution towards the knowledge of the linkage group in rice.)]**
Ber. Ohara Inst. 1931 : **5** : 1–56.

A variety " Murasaki-Waito " with dark purple coloured leaf blade, sheath, pulvinus, auricle, outer glumes, the tips of the inner glumes and stigma, practically awnless and dwarf in all its parts, was crossed with " Omati " which is an unusually large variety with awns and no purple colour.
Three genes, P_1, S and B were concerned with the colour of the leaf. It is suggested that in the absence of S and B no colour is developed and that B behaves as a modifier. The results also suggested the presence of a modifier of S, So, probably closely linked, which altered the colour of the glumes.
The results of F_2 indicated a trihybrid segregation for stigma colour, the three genes being S, B and Ps. Certain variations in the F_3 results, however, could be better explained by assuming that Ps was identical with S.
There was one gene, D for growth habit, the dwarf plants representing the recessive condition. In this cross the difference in time of heading of the parents was due to two factors, F_2 and F_3, both influenced by external conditions.
The behaviour of the genes, S, B, M, P, Ps, D, F_2 and F_3 concerned in this cross was then tested in pairs, in various combinations, for linkage.

Linkages were found between S–M, S–F_3, with a crossing over of 30·7 per cent, B–F_3 with a crossing over of probably 33 per cent and M–F_3 with a crossing over of 40 per cent in one case but no linkage in another. The investigation of the relation between S–Ps and B–Ps further supported the assumption that Ps is identical with S.

449. Sampietro, G. 633.18–2.8
Il brusone, le ipotesi vecchie e le loro contraddizioni. (**"Brusone," the old hypotheses and their contradiction.**)
Giorn. Risicolt. 1932 : **22** : 1–13.

Suggestions as to the causes of "brusone" have been many and various but none have proved adequate. Varieties, such as Chinese Originario, which when first introduced into Italy were completely resistant, after many years cultivation have shewn signs of susceptibility. It is suggested that the artificial conditions by preserving the weak as well as the strong types, has led to a degeneration of the strain. This weakening has exposed the enzymes, on which the life of the plant depends, to external conditions which are unfavourable to them and in consequence the whole plant suffers. Secondary effects, such as fungous attacks, then make their appearance. The only remedy lies in the search for resistant varieties from the centre of origin of rice and their hybridization with the cultivated varieties.

450. Krassochkin, V. T. and Ouzunov, V. N. 633.41:576.16
(**Beet in countries of their ancient cultivation.**)
Bull. Appl. Bot. Genet. and Plant–Breed. 1931 : **26** (2) 76–193.

Collections of wild beets were made in the central portion of the area of distribution of the genus and the material grown in a number of different stations in the U.S.S.R. differing very much in ecological conditions.

After an indication of the characters with regard to which the plants were examined, a description is given of the types found in each district.

The study clearly shews that the beets from southern countries constitute heterogeneous populations of a semi-cultivated kind. The individual characters shew a wide range of variability and also with regard to biological characters they can be divided up into a number of distinct types. The samples from Asia Minor differed very markedly in respect of flowering, some samples flowered all in the first year and in other samples none flowered in the first year. Botanically, great differences were also observed both in samples from different regions and within the samples. The distribution of the different forms in Asia Minor is shewn by tables and maps. The differences, certainly the differences in flowering, corresponded to some extent to the climatic conditions of the various districts. Many valuable agronomic characters are found in these forms.

A similar study is then given for Transcaucasia. The multiplicity of varieties of red forms and the high percentage of annual plants (frequently up to 100 per cent) are taken as strong indications that Transcaucasia, and in part Asia Minor, are the centres of origin of the red beet of the non-cultivated type and that these are the representatives of an ancient local form.

In Afghanistan and Persia flat and round white forms of low sugar content were endemic. Such forms are not now found in cultivation and are regarded as primitive forms, representing two stages in evolution, the flattened being recessive and less primitive than the rounded forms.

The beets of the Western Mediterranean countries were of less interest, mostly corresponding to one or other of the commercial forms.

Forms from northern Africa were largely early flowering and on all grounds were regarded as extremely primitive.

The material from the Central Asiatic possessions of the U.S.S.R. was of considerable variety, containing a number of local forms adapted to these particular conditions and offering a valuable field for selection.

Northern India had few forms, all annual, wild types. Forms nearly approaching to the wild type occurred also in Persia and North Africa—i.e. the southernmost regions of the distribution area. These forms displayed less variability.

The eastern Mediterranean countries, including Cyprus and Crete, were characterized by a concentration of early-flowering forage beets.

The variation of forms according to geographical regions is shewn in tabular form.
The literature of the annual flowering habit and its inheritance is reviewed. The authors conclude from their own work that the beet is one of those plants which " at will " may behave as an annual or a biennial, in other words the behaviour is influenced by environmental relationships. A series of comparative experiments proved that flowering is directly influenced by the latitude of the place at which the plant was grown and further experiments shewed the determining factor to be the length of day.
The different types of beet, originating in different countries, reacted quite differently to particular periods of daily illumination, e.g. the Afghan forms proved to be short-day, the Egyptian long-day ecotypes. An extension of the length of day caused an acceleration in the development of floral organs in the former type, resulting in the " annual " behaviour. Corresponding differences were observed in the reaction of the two types to different times of sowing. Beets from northern countries displayed the least, those from southern countries the most tendency to bolting.
Reduced temperature during germination produced no effect on the Egyptian type but in certain other varieties the proporiton of " annuals " was increased by this treatment.
The authors point out that the term " bolter " does not designate one type but many, since any stage of development may be reached in the first year, from the mere development of the flowering branch but no flowers, to the full development of ripe seeds. All these degrees are included under the term bolter. Similarly plants may be found at the end of the second year in any of these stages, requiring a third year to complete their development. These are the late plants, which also are undesirable from the point of view of the cultivator.
The extreme heterogeneity of the material indicates a great wealth of genes and presents possibilities to the breeder of producing new forms by hybridization, forms suited to conditions, especially in southern latitudes, different from those for which the present commercial types are suited.
The pinkish red and light red types were the most widely distributed.
The fact that the area of distribution of the wild beet coincides with that of the southern forms and with the regions of ancient cultivation leads to the conclusion that the centre of origin is the Mediterranean and the main form originating processes are thought to have occurred in the eastern portion, although the possibility is not excluded that the more western and northern countries also played a part. Certain of the forms found in the southern countries, although with regard to flowering they shewed themselves to be typical southern forms, displayed many points of similarity with modern cultivated types.

451. RUBASHEVSKAÏA, M. K. 633.41:576.16
(On some forms of the wild beet.)
Bull. Appl. Bot. Genet. and Plant–Breed. 1931 : **26** (2) 59–75.

The investigation was carried out on wild plants from various sources, all belonging to the species *Beta vulgaris perennis* L. Descriptions are given of the types observed amongst the Algerian wild beets. Among them were plants which flowered in the first year, a few in the second and some even in the third year when sown near Leningrad. The flowering is in close relationship with the length of day and the number of annual plants differed in different situations. The plants were much less subject to mosaic disease than the varieties from other sources.
A considerable number of distinct forms were observed, falling into rather clear regional groups and the authoress regards this material as of extreme interest from the point of view of the origin of the cultivated forms.

452. MORINAGA, T. 633.42:575.127.2:576.356.7
Interspecific hybridization in *Brassica*. IV. The cytology of F_1 hybrids of *B. carinata* and some other species with ten chromosomes.
Cytologia 1931 : **3** : 77–83.

Karpechenko has stated that *Raphanobrassica*, the constant tetraploid between *Raphanus sativus* and *B. oleracea*, (see Plant Breeding Abstracts Vol. I., Abst. 375 and 376) crosses more readily with *B. carinata*, which has seventeen gametic chromosomes, than with either parental species.

Crosses were made between *B. carinata* and various other species.
The hybrid with *B. chinensis* as female was sterile when bagged, though 1·6 per cent of fruits were produced by open pollination. The somatic division was normal, with 27 chromosomes. In the heterotypic division there were both bivalents and lagging univalents. The number of the latter varied from 9 to 25, with an average of 14. Those near the equator split and the halves went to the poles ; the rest moved intact.
The complete union of two homotypic spindles was a frequent occurrence and a giant plate with 27 chromosomes was once observed. Very rarely the heterotypic division was completely suppressed, with the formation of one large nucleus containing the total somatic number of chromosomes. More frequently the fusion of two homotypic spindles was observed.
In the cross with *B. Rapa* as pollen parent precisely similar conditions were observed.
The author concludes that *B. carinata* contains two genoms.

453. Frandsen, H. N. and Winge, Ö. 633.42:575.129
Brassica napocampestris, **a new constant amphidiploid species hybrid.**
Hereditas 1932 : **16** : 212–18.
Reciprocal crosses were made between swede and turnip. Very little seed was obtained, especially in the cross with turnip as female, in which only two F_2 plants were obtained.
The F_1 was mainly intermediate, having 28 chromosomes, the sum of the parental numbers 10 and 18. The fertility of the F_1 plants was low, giving on an average 0·5 g. of seeds per plant compared with 3·6 for swede. One plant, however, gave as much as 2·7 g. and this plant produced 286 F_2 plants. The progeny of this plant was very constant, contrasting with the varied products of segregation, even transgressive, in the other progenies. It is clearly a new constant amphidiploid species and has been named *B. napocampestris*.
The plants as expected proved to have 56 somatic chromosomes. The chromosome duplication apparently resulted from somatic doubling in the F_1 and apparently at the first division of the zygote, giving the whole plant the new chromosome number.

454. Tedin, O. 633.42:581.162.32
Korsningsfaran vid fröodling av rovor. **(Danger of crossing in seed production in turnips.)**
Landtmannen 1931 : **14** : 454–55.
Plants were examined which came from seed from individuals standing at the margin of two fields, one of white and the other of yellow fleshed roots. At the actual margin 18 per cent of the plants were hybrids, at a distance from 1·2 m. 5·7 per cent. A limit of 1 per cent was reached at 24 m., beyond which there was no perceptible fall.
The possible explanations for this are that the wind carries this small amount of pollen, or that a certain number of insects make long flights and are responsible for this small amount of crossing.

455. Stout, A. B. 633.42:581.162.52
Pollen tube behaviour in *Brassica pekinensis* with reference to self-incompatibility in fertilization.
Amer. J. Bot. 1931 : **18** : 686–95.
Selection for high grades of self-seeding was carried out for seven generations, during which time no plant was found which was entirely self-fertile. A period of self-fertilization occurred in the middle of the flowering period of these plants.
In the periods of incompatibility very few, if any, of the pollen tubes entered the style, many of these remaining coiled on the papillae. This coiling was not observed in the mid-period of compatibility, during which time a number of tubes passed through the style into the ovary.
In the transition periods all stages from production of viable seeds, to entire falling off of the pistils immediately after pollination, are observed.

456. Nagaharu, U. 633.426(52)
Varietal distinctions of the rape varieties grown in Japan.
J. Nishigahara Imp. Agric. Expt. Sta., Tokyo 1931 : **1** : 403–22.
The varieties of *Brassica campestris*, *B. napus* and *B. juncea* are described and their variations. The number of chromosomes observed is given.

457. SCHICK. 633.491(85)
Kort verslag van een reis door de Andesgebieden van Zuid–Amerika en de in deze gebieden gekweekte aardappelsoorten. (**Short report on a journey through the Andes regions of S. America and the potato varieties grown in these regions.**)
Landbouwk. Tijdschr. Groningen 1931 : **43** : 1133–36.

The greatest wealth of forms was found in the high plateaux of Bolivia and Peru, where about 300 varieties were found. The majority of the varieties are similar to the common types cultivated in Europe but some distinctly different types also occurred.
The collection has made it evident that the European varieties by no means exhaust the genic diversity of the genus. None of the specimens has yet proved immune to *Phytophthora* however. The author hopes to find frost-resistant types amongst them.
The author emphasizes the desirability of preventing these possibly valuable races dying out on account of the introduction of more productive types.

458. KRANTZ, F. A. and LEACH, J. G. 633.491:575
The need for a program of potato improvement.
Amer. Potato J. 1931 : **8** : 229–34.

Attention is called to a large number of respects in which the potato could be improved by modern breeding methods, which as a result of recent discoveries can now be applied to the potato. The average yield of 29 selected seedlings was 207·4 bushels per acre compared with 137·5 for the commonly grown local variety. It has recently been shewn that seedlings can be produced which maintain their type under a wide range of conditions. The author estimates the increase in production per acre which should result from these methods as 10—20 per cent.
Among the most important lines of improvement are breeding for resistance to frost and various fungous diseases. Such improvement can only be brought about by a comprehensive programme embracing the country as a whole.

459. SEMSROTH, H. 633.491:575
Die Nachkommen der Kartoffelsorte Industrie und deren Verwendbarkeit in der Kartoffelzüchtung. (**The varieties resulting from the potato variety Industrie and their use for breeding.**)
Fortschr. Landw. 1931 : **6** : 554–56.

The parentage, as far as it is known, of the variety Industrie is given and then a chronological account of the numerous commercial varieties which have been bred from this variety, with indications of their parentage and their value, or otherwise, for further breeding.
For many years these varieties were all susceptible to wart and scab but in 1928 and after, a number of varieties, resistant some to the one and some to the other, arose from crosses with the varieties Jubel and Lech. The parentages of all the varieties originating from Industrie are given in a table. Of these 13 have been resistant to wart and 3 to scab.

460. CLARK, C. F. 633.491:576.16:575.255
The origin by mutation of some American potato varieties.
Proc. Pot. Ass. Amer. 1930 : **17** : 117–24.

The origin of certain varieties is uncertain. A number of these varieties was subjected to treatment whereby shoots arose from the lower layers of the tuber, these shoots were compared with those arising in the normal way from the other half of the tuber.
Four of the varieties so treated gave shoots similar to some other known variety and are apparently mutants—periclinal chimaeras—from these respective varieties. The varieties Blue Victor and People's thus appeared to be mutant forms from Peerless, Noroton Beauty from Triumph and Russet Rural from Rural New Yorker No. 2.

461. KOSMAT, H. 633.491:576.341
Saugkraftmessungen an Kartoffelsorten 1930/31. **(Osmotic pressure determinations on potato varieties 1930/31.)**
Fortschr. Landw. 1931 : **6** : 712–17.
Correlations were found between high osmotic pressure and earliness.
Definite osmotic pressures were characteristic for particular systematic groups. The types with high osmotic pressures were less exacting with regard to soil, water and other growth conditions, consequently such types have tended to be regarded as drought resistant.
Selection experiments based on osmotic pressure were carried out on a commercial, therefore not pure, strain of Early Rose. Tubers were sprouted in the light. The observations shewed that different sprouts from the same plant had almost identical osmotic pressure. The plants with highest values flowered 9 days earlier than those at the other extreme and the yield difference between the 2 groups was about 30 per cent. With high yield and early flowering was also associated a greater length of sprout.
This is regarded as the most suitable method of selection.

462. ELMER, O. H. 633.491–2.484:576.16
Pathogenic and cultural comparisons of strains of *Rhizoctonia solani*. (Abst.)
Phytopathology 1932 : **22** : 8–9.
Various distinct types were observed.

463. CLARK, C. F., STUART, W. and STEVENSON, F. J. 633.491–2.8–1.521.6:575
The Katahdin potato : a new variety.
Amer. Potato J. 1931 : **8** : 121–25.
In the production of the older varieties only resistance to *Phytophthora infestans* was taken into account and the varieties are for the most part not resistant to virus. Selection for virus resistance has been undertaken more recently. The Katahdin variety originated from a cross between two unnamed seedlings from a cross made for mosaic resistance and good shape of tubers ; the pedigree is given. The variety has proved highly resistant to mosaic, having smooth, well shaped tubers and apparently higher yield than the parents and rather good eating quality. A full description of the variety is given ; a number of other desirable characters are claimed for it. It is suited more to peat soils.

464. BEY, F. A. 633.51 Maarad
Maarad cotton.
5th Congr. Internat. d'Agric. Trop. 1930 : 486–97.
After a very brief indication of the origin of Maarad cotton by selection from Pima, itself a mutation from the Egyptian variety Mit Afifi, the qualities of the cotton are described and the views of the spinners quoted. It has given yields of 33 per cent more than Sakel. Giza 7 gives similarly high yields. Its staple is longer than Sakel. by 2–3 mm. and finer, its ginning out-turn 2–3 per cent more. It is more resistant to wilt than Sakel., is earlier and less attacked by pink boll-worm. Its root system is shallower and it is somewhat less resistant to drought. In 1928 it was superior in strength to Domains Sakel., although in previous years it had been not so strong.

465. EMME, H. 633.51:575.1:061
633.51:576.312.35
Ueber Chromosomen der Baumwolle, Vererbung ihrer Blüten–, Frucht– und Samenmerkmale. **(Chromosomes of cotton, inheritance of flower, fruit and seed characters.)**
Der Züchter 1932 : **4** : 9–18.

Vererbung vegetativer und physiologischer Merkmale der Baumwolle und Besprechung weiterer Fragen über die Genetik der Baumwolle. (**Inheritance of vegetative and physiological characters in cotton and a discussion of further questions relating to the genetics of cotton.**)
Der Züchter 1932 : **4** : 39–49.

A brief but comprehensive review of the published work on the classification, chromosome numbers and genetics of cotton.

466. HIRATA, K. 633.522:577.833:575
Heredity of intersexuality in hemp.
Jap. J. Genet. 1931 : **7** : 103–05.

On repeated self-pollination of female intersexual hemps no male plants appeared in the progeny and the frequency of production of female intersexes increased with each generation. Eventually there were no female plants at all. This was accompanied by a decrease in germinating percentage.
The author considers that the intersexuality is influenced by genetic factors.

467. WETTSTEIN-WESTERSHEIM, W. v. 633.584.3:575
Zur Verbesserung der Schälweide *Salix americana* Hort. (**The improvement of the bark willow, *Salix americana* Hort.**)
Der Züchter 1931 : **3** : 369–70.

This valuable variety, characterized by peeling with ease, should be susceptible of improvement by cross-breeding to increase the tannin in the bark, which would act as a protection against animal pests, and to produce a form less exacting as regards cultural conditions. The barks would then be capable of use for tanning.
It has been crossed on to *S. caprea viminalis* and *S. purpurea*. The F_1's are promising and are going to be bred further.

468. DAS, N. K. 633.61:575(54.8)
Cane breeding in Coimbatore.
Hawaii Planters' Rec. 1931 : **35** : 163–200.

A description of the Imperial Sugar Cane Station and its work, with an outline of some of the results obtained and a list of the cane crosses made.

469. JESWIET, J. 633.61:575.12:608.3
Protection du droit de propriété des hybrides nouveaux de *Saccharum officinarum* L. (**Protection of the property right of new hybrids of *Saccharum officinarum* L.**)
Rev. Bot. Appl. d'Agric. Trop. 1931 : **11** : 939–42.

A report of an address by J. Jeswiet at the XV Agricultural Congress at Prague 1931.
It is pointed out that the Java varieties, the fruit of years of research maintained at the expense of the Java sugar industry, have been utilized by many other countries to compete with that industry.
Dr. Jeswiet considers that some international agreement for protecting the products of the breeder is desirable. The Dutch government in Java has already taken steps to prevent the export of new varieties of sugarcane and other crops produced by the Experiment Stations.

470. 633.61:575.127:633.17
Kruisingen tusschen suikerriet en Kaffercorn. (**Crosses between sugar cane and Kaffir corn.**)
Arch. Suikerind. Ned.-Ind. 1931 : **39** : p. 1224.

Reference is made to the sugar cane x sorghum hybrids obtained at Coimbatore, after which it is remarked that Dr. C. L. Rümke has since 1928 been studying the question of intergeneric crossing with *Saccharum* and *Eranthus*. Already the " third nobilization " has been attained. Crossing with *Andropogon Sorghum* has recently been taken up.

471. BREMER, G. 633.61:576.312.35:576.16
De cytologie van het suikerriet. VI. Een cytologisch onderzoek van een aantal oorspronkelijke Britsch-Indische suikerrietsoorten. (**The cytology of the sugar cane. VI. A cytological investigation of a number of original Indian cane varieties.**)
Arch. Suikerind. Ned.-Ind. 1931 : **3** : 1349–91.

Descriptions are given of all the canes examined, including data of their fertility and flowering characters. The canes studied all belong to the group *S. Barberi* Jeswiet. Chromosome counts were made in root tip by the method described in the previous number of the series (see " Plant Breeding Abstracts " Vol. II, Abst. No. 110). For some varieties the reduction division was examined.

In Chunnee 91 somatic chromosomes were counted. Metaphase examinations have shewn the presence of 1 to 9 univalents with corresponding numbers of bivalents. Certain other varieties behaved identically with Chunnee being also characterized by the presence of a small body near one of the poles, the remains of the nucleolus and a phenomenon characteristic of these Indian canes. Other members of this group referred to as the *Saretha* group, had 90 and 92 somatic chromosomes.

Some varieties of the *Sunnabile* group were characterized by 114—118 somatic chromosomes, in Rakhra there appeared 38 bivalents and 6 univalents, somatic counts shewing regularly 82. Other varieties of the group were apparently similar ; the number of bivalents was sometimes more and in certain cases less than 6. Varying numbers from 80 to 86 were observed in other varieties of the group ; these may or may not be due to errors of observation.

The number 124 was characteristic for another group of varieties whilst 2 extremely similar varieties had 107, with usually 51 bivalents and 5 univalents at metaphase.

A cane known as Yellow Egyptian, thought to be the same as Creole, is discussed in a separate section ; 81 was established as the somatic number with 39 bivalents and 3 univalents at metaphase of the reduction division. This leads the author to regard this cane as a hybrid between the *Mungo* Indian cane with 41 and a noble cane with 40. The characteristic remains of the nucleolus referred to above was also observed here, a phenomenon which in *S. officinarum* is never observed. This affords a further indication of the Indian and hybrid origin of the Creole cane.

On the ground of these chromosome numbers 1 or 2 rearrangements in the grouping of the canes in this section are suggested. The 107 chromosome canes are regarded as in all probability hybrids between members of the *Nargori* group with 62 haploid chromosomes and the *Saretha* group with 45. The new grouping is given and is found to correspond very closely to that originally suggested by Barber.

Jeswiet's species *S. Barberi*, which embraces 4 of Barber's 5 groups is seen to be composite. The *Saretha* group is uniform and fertile and deserving of a specific status. The *Mungo* and *Nargori* groups are probably of hybrid origin, which accounts for their reduced fertility. There is no doubt in the author's mind that *S. Barberi* will have to be divided into a number of distinct species.

The probable origin of this group of canes is discussed. The existence of a variety with 60 diploid chromosomes indicates the existence of a *Saccharum* species yet unknown, coming much nearer to the basal form which should have had 10, the number characteristic for the Andropogoneae. The forms with lower numbers are not yet known and it is possible that they have quite died out. The whole question of origins is still very much in the dark. It seems highly probable that the group under discussion has arisen by some highly complicated process of hybridization.

472. SARTORIS, G. B. 633.61:581.48:578.082
The preservation of sugar cane seed.
Facts about Sug. 1931 : **26** : p. 536.

Healthy seedlings were produced from seeds that were several months old by special methods of packing, which are described. The results with the method of preservation using calcium chloride and carbon dioxide were to all intents and purposes equal to those using fresh seed. Such seed retained its viability for 8 months at room temperature.

473. MALPEAUX, L. 633.63:575
Pour l'amélioration de la betterave à sucre. **(The improvement of the sugar beet.)**
Vie Agric. Rur. 1931 : **20** : 225–28.
To economize in labour, a variety with not so long a root, fewer rootlets and growing a little out of the ground is desired. The hybrids obtained up to now have, if satisfactory in shape, been deficient in sugar content or have not been constant.
The attempts made to select a strain of winter beet, both in France and other countries have not yet been entirely successful.
The methods suggested for the elimination of bolting are discussed.

474. JAROSHEVSKY, P. 633.63:575(47)
(Complex-biological study of beet with the view of practical appliance in beet breeding and agro-technic.)
Nauk. Zapiski Tsukr. Prom. 1931 : **14** : 271–98.
Extensive investigations have been made on a number of biological characters and their correlation with yield and sugar content. A strong positive correlation was observed between weight of root and the following : number, length of petiole and lamina, width, area of lamina and of leaf and thickness of petiole. Plants whose leaves form early, develop rapidly and die early, are characterized by low sugar content and small roots. High ratio of root weight to unit of leaf surface was shewn to be a hereditary character and correlated with large weight of root. Sugar content and other characters of commercial importance were not correlated with any of the characters of the leaf. The seed production and other second year characters were likewise independent of the first year (vegetative) characters. Flowering and the success of self-fertilization and other such characters were highly susceptible to influences of environment. Morphological characters shewed no association with productivity and are of interest only for themselves and from the point of view of systematics and genetics.
On the basis of these observations a programme of breeding is outlined.
Attention is being given to the elaboration of a method, besides ordinary inbreeding, whereby progeny as nearly as possible like the parents may be obtained.
Much use is being made of a method of sowing the plants in the winter in the greenhouse and planting out in the spring, whereby an increase of three times in the leaf surface can be gained with no reduction in sugar content.

475. *ARCHIMOVITCH, A. 633.63:575.14
633.63:575.12:578.08
(On the inbreeding method applied to the sugar beet.)
Trans. Belaya Tserkov Plant-Breed. Sta. 1931 : **6** : Par. 3.
The author starts with a general discussion of inbreeding and heterosis. He points out that in addition to the numerous monstrous and undesirable recessives that have segregated out on inbreeding maize, various valuable recessives such as disease and cold resistance, etc., have also appeared, just as they have appeared on the peripheral areas of distribution in nature.
The third inbred generation (J_3) is described. Reduced sugar content, weight, size of plants, sometimes enlarged form of roots, extremely small yield of seed and various other undesirable results of inbreeding are mentioned.
By continued selection a considerable number of plants having a high degree of autofertility has been isolated. Such plants retained their high fertility, as opposed to the majority, in which the fertility decreased from generation to generation.
Tests of the efficiency of Munerati isolators were made by growing isolated plants of culinary beet in the vicinity of isolated sugar beets. The number of crosses with the culinary beet was only in the order of 11 in 700. A new isolator of the same type has been devised, having walls of glass and veneer, the roof only being of cloth. Such isolators are said to be more efficient.
Hjalmar Nilsson's method of isolating individual branches with parchment was only successful when the branches were moistened before applying the isolator. In any case this method was less efficient.

* A fuller summary of this paper is on file at the Bureau.

The advantages of spatial isolation are discussed. Preliminary experiments shewed that the percentage cross-pollination at a distance of 30 m. was 9·36, falling to 0·30 at 565 m. Examinations were made of the amount of cross-pollination between culinary and sugar beets in the field. These shewed that by sowing plants of one type separately at some distance from one another and surrounded by plants of another type nearly 100 per cent hybrid seeds can be obtained. By enclosing two different plants in the same Munerati isolator 3903 hybrids as against 226 non-hybrids were obtained, whilst only 0·47 per cent false plants occurred in the progenies obtained by isolating two plants of the same type together.
The maximum seed set was obtained by pollinating the day after emasculation, the maximum of desired hybrids by pollinating immediately. The results of using pollen of various ages are given.

476. SAILLARD, E. and VILMORIN, J. DE 633.63:581.162.32
Crossings between wild beets and sugar beets.
Supp. Circ. Hebd. 1931 : Nov. 1, No. 2223.
A report submitted by the authors at a convention of sugar beet experts held at Brussels. Numerous crosses have been made by the Vilmorin seed firm at Verriers, between different types of wild and cultivated beets. Crosses with the wild beet *Beta trigyna* have been unsuccessful. Some of the first generation crosses have had a sugar content of 19—20 per cent but the results on the whole are not encouraging. Types immune from *Cercospora* have appeared however.

477. JAKYSHKINA, O. V. 633.63:581.192
(Contribution to characterizing mother beet brands following the data obtained during variety tests at Ramon Station 1925-1929.)
Nauk. Zapiski Tsukr. Prom. 1931 : **13** : 823–30.
By testing the purity and content of sugar and non-sugar materials of the juice of various sugar beet varieties the authoress established 4 groups, viz. those with high sugar and high purity, high sugar and low purity, high yield and high purity and high yield and low purity ; that is, there was no connection between purity and sugar content and the creation of races having high sugar content and high purity is a practicable possibility.

478. BRZEK, J. 633.63:581.192:575
Zusammensetzung der Rübe und der Säfte von abnormal günstigen Quotienten.
(Abnormally favourable composition of beet and sap.)
Z. Zuckerind. Böhm. 1931 : **56** : 73–77.
A detailed report is given of a sugar beet from the Semčice breeding station. The purity of the juice amounted to 94·7 and this by liming with CaO was increased to 97·16. The sugar percentage was 17·75. This is very much in excess of the purity of the average beet and represents not more than half the non-sugar usually found. Both the nitrogen content and the ash content were unusually low.
The author admits that the plant was produced under particularly favourable conditions but regards as the chief cause of its excellence the systematic selection which had led to its production. It is hoped that it may be possible by breeding to establish strains of commercial beets of this calibre.

479. VONDRAK. 633.63:581.192:575
Die Rübe der Zukunft. **(The beet of the future.)**
Zbl. Zuckerind. 1931 : **39** : p. 1142.
Referring to a review of the article by Brzek (see preceding abstract) in which the reviewer expresses scepticism as to the possibility of generally attaining quality such as that of the beet in question, the present author calls attention to the signal improvement which has been brought about in the last 32 years. The beet in question shews that such a high degree of purity is biologically possible and many cases are known in which values nearly approaching this have been observed. The author concludes that there are no grounds for considering that improvement in the future is impossible or improbable.

480. ROEMER, T. 633.63–1.547.4
Running to seed as a varietal characteristic of sugar beets.
Zuckerrübenbau 1931 : **13** : 169–73.
Certain strains produced by the breeders, it is pointed out, display a very much reduced tendency to bolt under conditions of early planting.

481. TISDALE, W. B. 633.71–2.411.4–1.521.6:575
Development of strains of cigar wrapper tobacco resistant to black-shank (*Phytophthora nicotianae* Breda de Haan).
Bull. Florida Agric. Expt. Sta. 1931 : **226** : 45 pp.
Resistant strains were obtained from Big Cuba and certain other varieties by repeated selection of the plants least attacked by *Phytophthora nicotianae*.
Crosses were then made between these strains and varieties giving high yields of leaf of good quality. The F_2's of these crosses were grown on thoroughly infected soil. Of the resistant segregates only those with the desired quality were retained. The progenies of each cross and the lines selected are described. One of the most promising was a line from an accidental hybrid. No sharp segregation into resistant and susceptible was observed but the method of selection led to a gradual increase of resistance in successive generations.
Resistance was clearly not conditioned by a single factor pair. Environmental conditions also had a marked effect on resistance and it is probable that absolute resistance does not exist. Resistance did not appear, however, to be linked in any way with leaf characters.
Some of the new strains are highly resistant, at the same time possessing a leaf of admirable quality in all important respects, together with other desirable qualities such as high yield.

482. GOUBEAUX, M. J. 633.72(59.7)
Notes sur le Théier au Laos. (**Notes on the tea plant at Laos.**)
Agric. Prat. Pays Chauds (N.S.) 1932 : **3** : (20) : 89–102.
In the highlands of Indo-China, tea grows wild and there is a multitude of forms, some rivalling the best selected Assam tea plants. In a country offering all the natural conditions for tea cultivation, the tea grown comes from foreign sources.
An experimental station has recently been established at Tranninh, close to where the wild tea grows and the work at present is to isolate and select the wild types.

483. MELLO GERALDES, C. DE 633.73(67.9)
Aperçu sur le café aux colonies portugaises. (**Notes on coffee in the Portuguese colonies.**)
Bol. Agencia Geral Colon., Lisboa, 1930 : **6** (57) : 22–34.
In the virgin forest a number of wild species are found, notably *Coffea Welwitschii* ; also *C. melanocarpa*, *C. jasminiodes* and *C. hypoglauca*. The *canephora* group is mostly cultivated.

484. TASCHDJIAN, E. 633.73:575.22
633.73:575.115
633.73:581.162.3
Beobachtungen über Variabilität, Dominanz und Vizinismus bei *Coffea arabica*. (**Observations on variability, dominance and vicinism in *Coffea arabica*.**)
Z. Züchtung 1932 : **A.17** : 341–54.
Of the varieties of *C. arabica* grown at São Paulo, most are forms of *C. arabica* var. *typica*. This, however, is not true of Café Bourbon which besides the Café Nacional is the most commonly cultivated coffee and from which it is only to be distinguished by the light green colour of the young leaves in contrast to the reddish to bronze colour of those of Café Nacional. The origin of Café Bourbon is unknown. It is possibly the result of a cross between Café Nacional and *C. arabica* var. *murta*.
The results of the cross D'Utra x Amarello indicate that the yellow colour is dominant to red. Other crosses shewed that large seeds were probably dominant to small seeds.
A variation is described in which the corolla persists and is named *C. arabica* var. *goiaba*.

In connection with the fasciated form, *C. arabica* var. *polysperma*, observations on seedlings of normal coffee shewed plants with from 2—6 leaves. Also the size and shape of the leaves were very variable. Albino seedlings and other chlorophyll variants were found.
The question of self-pollination was tested by removing all the flowers but one from a branch and enclosing this in a parchment bag. Fruit set normally without exception. In this, *C. arabica* differs from *C. robusta* and other varieties which set very little fruit when the branches are enclosed in gauze. Very few fruits set when the flowers were only wind pollinated, insects and self-pollination being excluded. Experiments on cross-pollination, using a fasciated form and a red seedling form as indicators, shewed a cross-pollination of 40—90 per cent—generally more than 50 per cent.

485. WELLENSIEK, S. J. 633.74:575.11.061.6:581.48
De erfelijkheid van zaadlobkleur bij cacao als basis voor qualiteits-selectie. (**The genetics of cotyledon-colour in cocoa as a basis for quality-selection.**)
Arch. Koffiec. Ned.-Ind. 1931 : **5** : 217–33.
White cotyledons, such as the old Criollo possessed, give a higher quality finished product and are for this reason desirable. The types at present in cultivation are largely Forastero-Criollo hybrids and very variable with regard to cotyledon colour.
The artificial reciprocal cross of Criollo (white) and Forastero (dark purple) gave dark purple hybrid seeds in both cases.
A number of old Angoleta mother trees was examined. Two of these gave constant seeds, seven gave seeds shewing clear segregation ; the trees were evidently heterozygous for colour and their seeds thus constituted an F_2 population. The seeds from these seven trees were divided into equal colour classes. Taking three of these classes as coloured and the remaining two as not-coloured the ratio closely approximates to 3 : 1 and the author suggests that one basal gene for colour is operative, together with one or more pairs of genes governing the intensity. The progenies of the individual trees are in more or less conformity with these relations and similar figures were given by another group of trees on another estate.
There were also available five groups of seedlings from these old mother trees, whose seeds therefore constituted an F_3. Some of these " F_3 families " segregated into coloured and not-coloured in ratios in general agreement with the expected 3 : 1. Others shewed no segregation, being uniformly coloured. The ratio of the number of segregating to the number of not-segregating groups was 17 : 6.
Certain other lots of trees shewed not such good agreement, there being a deficiency of recessives. Other lots again gave very close agreements. The total number of segregating to non-segregating groups was 66 : 27 and the total of coloured to non-coloured of all the segregating groups was 2120 : 619 compared with an expected of 2054 : 685. This is just within the limit of three times the standard deviation.
In discussing the results the author remarks that although the classification into the various colour groups was sometimes difficult, the line between the coloured and non-coloured was usually quite clear. The deviations from the theoretically expected ratios nearly always take the form of a deficiency of the recessives and it is pointed out that this is not an altogether unusual occurrence. A total of five progenies breeding true to whiteness was found. This is again much below expectation and supports the assumption that the recessive forms are less viable.
In applying these results to the practice of selection the author recommends that 30 or 40 seeds of each mother tree should be examined and only those trees retained which furnish only white cotyledoned seeds ; only on these should the ordinary yield determinations be made. In this way it is hoped to improve the quality as well as the yield of cacao.

486. CHARBONNEL, J. B. 633.822:576.16
Contre l'hybridité du *Mentha piperita* Huds. (**A denial of the hybridity of *Mentha piperita* Huds.**)
Bull. Soc. Bot. Fr. 1931 : **78** : 452–53.
The author denies the hybridity of the species on the grounds of the morphological comparison of the species with the supposed parental species.

487. WILDEMAN, E. DE 633.855.34:581.162.3
La fécondation artificielle chez les palmiers à huile. (**Artificial pollination in the oil palm.**)
Matières Grasses 1931 : **23** : p. 9275.
The results of artificial pollination on the yield of fruit shew a very marked increase in experiments made by Bunting at Kuala Lumpur and Serdang, F.M.S.
The experiments were made on young trees and it is possible that the effect may eventually be injurious. It is pointed out that even if such is the case, which remains to be proved, it may be worth while to grow the young trees closer together and replant when necessary. In the meantime, artificial pollination merits introduction into palm growing districts where it may increase production without seriously increasing costs.

488. GUNST, H. J. V. 633.912:575.42
Variabiliteit in hevea-cloon en boom en het selectief uitdunnen. (**Variation in Hevea clones and trees and selective thinning.**)
De Bergcultures 1931 : **5** : 1396–1400.
Figures are given for a number of trees of a clone, shewing the great variation in yield per tree over a period of five years. These figures shew the yields of the young trees are by no means a sure indication of the eventual yield and selective thinning in the early years can only with certainty be done on obviously inferior or diseased trees.

489. PASHKEWITCH, V. V. 634:581.162.5
(**Sterility and degree of productivity in fruit growing in dependence on the pollinating variety.**)
Supp. 49 Bull. Appl. Bot. Genet. and Plant-Breed. 1930 : 201 pp.
A full account is given of 5 year's work, beginning with 1924, on the effects of cross and self-fertilization in a number of different fruit trees, supplemented by data obtained from other workers.
The work starts with a general account of the study of the pollen and its germination, the methods of pollination and other operations. Separate sections are then devoted to the results of :—
(1) Self-pollination in apples in different places and in different years, the results being tabulated in full. There was a clear, though slight, increase in the set in self-sterile varieties when artificially self-pollinated. Only results obtained by the latter method are therefore regarded as absolutely accurate.
Pollination by pollen from another tree of the same variety tended to be more successful than from another flower of the same tree.
There were frequent borderline cases between fertility and sterility. Such types can often be regarded for practical purposes as fertile. Varieties are divided into 3 groups, absolutely sterile—i.e. 0 to 3 per cent fertility, slightly fertile—4 to 10 per cent and fertile—10 to 50 per cent. The majority of varieties fall into the first group ; the actual percentages for the varieties in the third group are given.
(2) Cross-pollination in apples. The results of these experiments are given in the same way. The varieties are arranged in intersterile groups. The results of pollinating each variety with a number of others shewed the different tendency of the varieties to cross-pollination. On the basis of these observations the most suitable combinations of 2 and more varieties are predicted. The results of a number of these combinations are given. By this means sets of up to 50 per cent were obtained.
Fertility tests were made with 86 varieties in 672 combinations ; 44 of these (in 160 combinations) were intersterile and 82 (in 512 combinations) fertile in varying degrees..
There follows an account of the morphology of the flower in the different varieties. The varieties, according to K. F. Kostina, are divided into 6 groups according to the relation between the height of the style and the stigma.
Pears are treated in the same way in the following section, then plums, cherries, peaches, almonds, apricots and *Sorbus* are discussed more briefly.
In the general discussion which follows, the capacity of various apple varieties to develop parthenocarpic fruits is discussed. The development of seedless fruits by self-pollination is

regarded as equivalent to parthenocarpy. A number of cases of " metaxenia " are quoted and the influence of the number of seeds (and so of the pollination) on the weight and form of the fruit is shewn to be still not entirely cleared up, although in a number of cases a direct relationship can be established. A pollinator which produces the largest fruits does not always produce the greatest number of seeds however.

The fruits obtained from artificial self or cross–pollination in apples were in general smaller than the free-pollinated controls but in pears the controls were usually of intermediate value. The pollinator giving the heaviest fruits is indicated for various varieties ; pollinating varieties which gave large fruits with one variety might reduce the size of fruits in certain other varieties. The greatest weights were sometimes observed in self-pollinated fruits. Sometimes the pollinators giving the largest number of fruits had a depressing influence on their size.

In certain varieties the seeds produced by self-pollination germinated, though not so well as normal seeds ; in others they were incapable of germination. These latter varieties were normally characterized by low germination capacity. It is pointed out that differences in germinating power of the seeds should be included in the degrees of self-sterility, as also the failure of seedlings to grow to a fully normal plant. The varying degrees of sterility and of parthenocarpy are indicated. Parthenocarpy is regarded only as one of the stages between fertility and sterility. Similar stages are observed both in respect of self and of cross–sterility. The possibility is suggested of obtaining varieties which regularly give parthenocarpic fruits.

The author points out that not only very distantly related forms but also very closely related forms are sterile when crossed and that the best results are obtained within certain intermediate limits.

Various other factors which influence the fertility to a greater or less extent and a number of points which still require investigation are indicated.

The work terminates with a detailed table of instructions on the method of performing pollination.

490. Vincent, C. C. and Longley, L. E. 634.11:575.1(79.6)

Apple breeding in Idaho.

Res. Bull. Idaho Agric. Expt. Sta. 1931 : **8** : 58 pp.

Very large numbers of F_1 seedlings were raised and studied with respect to various characters of tree and fruit. Upright growth of tree appeared to be dominant to the spreading types. The progenies of different trees clearly differed in the time of coming into bearing.

The Ben Davis fruit shape was more or less dominant in crosses with Jonathan although Jonathan-like type occurred in the offspring, together with intermediates and types differing from either parent. The condition was the same in some of the other combinations, whilst in certain cases the number of types intermediate or unlike the parents was proportionally much greater. The results make it clear that several factors determining fruit form are operative and the parents are heterozygous.

Measurements were made of length and greatest diameter, which displayed a high degree of correlation. Indices for tapering shewed the majority very close to the mean of the parents, with a considerable number of deviations.

The hybrids were arranged according to toughness and thickness of skin. The two were closely correlated. Types tougher and thicker than any of the commercial were not infrequent.

In respect of colour, the majority of the hybrids in the cross Ben Davis x Jonathan resembled the former (streaked), some were like Jonathan and a few were blushed. This is the case in other crosses of Ben Davis except that in all other crosses apples without colour appeared ; this occurred extremely rarely in crosses involving Jonathan.

There was also a correlation between coarseness and toughness of flesh and vice versa. Very few had sufficient tenderness for a successful commercial variety.

The apples were mostly medium to small in size but individuals both larger and smaller than either parent were found.

The percentage of malic acid in the juice varied widely in all crosses, the means being different for the different crosses, in the main corresponding to the character of the parent.

There was a high proportion of yellow or greenish flecked apples in the progeny. The progeny of each cross exhibited the entire range of flesh colour.

491. Evreinoff, W. A. 634.11:576.312.3
Étude caryologique comparée des variétés de pommiers comme base d'un système pomologique. (**Comparative caryological studies of apple varieties as a basis for their systematics.**)
Rev. Gen. Bot. 1931 : **43** : 474–90.

The reduction division was studied for a number of varieties and the haploid chromosome numbers are given. It was evident that those varieties in which the reduction division was irregular were characterized by inconstancy of type in the fruit. Chromosome numbers varying from 12 to 24 were observed. A whole series of varieties, of which Calville was the type, was characterized by the number 16 and is regarded as a natural group or family ; one of these varieties also contained flowers with 32 and others with 24 and other variations were observable in form of chromosomes, together with corresponding variations in fruit type.
A second group represented by the Reinettes contrasted with the above by force of its great uniformity. The author proposes to divide this group into sub-groups having the chromosome numbers (a) 12 and 18, (b) 20, (c) 24, each sub-group having a distinct fruit type.
The chromosomes in varieties of recent origin are said to be larger in size than those of older varieties and the vigour and size of trees and fruits correspondingly greater.
The caryological method is regarded as more sound for classification than the method based on the form of fruits.

492. Hall, S. R. 634.11:581.162.5
The problem of unfruitfulness in the cultivated apple.
Amer. Nat. 1931 : **65** : 512–30.

This paper contains a critical review of the work done on the problem.
A table compiled from the results of 25 investigators on the self-sterility of 18 varieties of apples shew how greatly these results may vary and the data on cross incompatibility are even less consistent. It is clear, however, that cross-pollination does increase fruitfulness. It is possible that the self-sterility of the apple may be explainable on the same lines as that of tobacco and other plants, by genetical factors. The extreme heterozygosity of the apple should also mean that, of the large number of genotypes produced among the pollen grains, some should be functional on their own ovules.
The poor results of cross-pollination have been traced to poor germination.
Parthenocarpy is a condition deserving more attention. The significance of chromosome number is discussed.

493. Heilborn, O. 634.11:581.162.5:575.113.7
Lethal gene-combinations and pollen sterility in diploid apple varieties. A critique and a theory.
Hereditas 1932 : **16** : 1–18.

Experiments made by the author shewed that differences in pollen fertility between the varieties are little influenced by climatic changes and are constant from year to year. Observed cases of sterility appear to be due to lethal gene combinations. In diploid varieties the pollen grains could be clearly distinguished as good and viable or aborted and non-viable. The conditions in the triploids were more complicated owing to the frequent occurrence of grains which, although apparently sound, did not germinate.
Attention is called to the comparatively small number of grains counted by previous authors in making germination tests, and this is thought to be the reason for the variation in the results, rather than any actual lack of uniformity in the varieties themselves.
There is one group of the diploids in which the pollen is fully fertile and the occurrence of 50 per cent, 75 per cent and intermediate degrees of viability is elucidated by the view that the diploids are secondary polyploids as postulated by Darlington and Moffett. Data in the literature indicate that the viability in diploids is never less than 50 per cent.

494. EVREINOFF, V. 634.25:575.182
Sur la question des xenies de 2e ordre chez le pêcher. **(Xenia of the second order in peaches.)**
Bull. Mens. Soc. Nat. Hort. Fr. 1931 : **4** : 426–29.
Various cases are cited in which the fruit of certain species is influenced in character according to the pollinating variety, including a case of the peach Rossanne observed by the author. The size, shape, flavour and colour of the fruits in many cases markedly resembled that of Triomphe de Saint-Laurent which was growing near it. The fruits also acquired the character of adherent stone characteristic of the latter variety. The time of ripening was intermediate between the two varieties.
The fruits of the Triomphe were unchanged.

495. WEBBER, H. J. 634.3:581.162.3
Influence of pollination on set of fruit in Citrus.
Calif. Citrogr. 1930 : **15** : 304, 322–23.
The flowers are visited abundantly by bees. As far as evidence goes all citrus are self-fertile although fruit obtained by cross-fertilization is usually more vigorous.
Apogamy is general, being brought about by the specialization of nucellar cells and development into embryos. These frequently develop at the expense of sexually produced embryos, especially in orange and grape-fruit.
In Washington Navels (seedless) very few anthers contain pollen and this is often non-viable. Development of pollen was arrested after the pollen mother cell stage. All degrees from fertility to sterility are found. The same applies to the ovaries. These navel types develop perfect fruits without pollination.
The author is of the opinion that pollination has no effect on the fruitfulness of the plantations.

496. JANINI JANINI, R. 634.31:575.12:578.08
La fecundación artificial en los naranjos. Obtención de nuevas variedades **(Artificial fertilization of oranges. Production of new varieties.)**
Agricultura. Rev. Agropecuaria 1932 : **4** (38) : 97–101.
The morphology of the flower is described in detail but in popular terms, with illustrations. The method of fertilization is then described.

497 McCLELLAND, T. B. 634.61–1.557:575.42
Experiments with fertilisers on coconut palms and variation in palm productivity.
Bull. P. Rico Agric. Expt. Sta. 1931 : **34** : 23 pp.
Individual yield tests were made over a considerable number of years for nearly 500 palms of varying ages.
The differences in yield resulting from the application of fertilizers were much less than the individual differences between the palms. The 20 lowest yielders produced 2,161 nuts during a time when the 20 best produced 6,938. Of the 25 highest yielding palms 8 received no fertilizer. These results shew that enhanced yields are to be expected from careful selection of parent palms rather than from fertilizers.

498. DARROW, G. M. 634.715:575.255:581.49
A productive thornless sport of the evergreen blackberry.
J. Hered. 1931 : **22** : 405–06.
A thornless plant is described which has arisen as a sport of the common thorny type and is equally productive. Certain canes thorny on one side and thornless on the other were found, root cuttings were thorny and no thornless plants have appeared amongst its seedlings. The plant is evidently a chimaera.

499. PAVLOVA, N. M. 634.72:575.1:576.312
(Summary of cytogenetic data on the genus *Ribes* L.)
Bull. Appl. Bot. Genet. and Plant-Breed. 1930-31 : **25** (5) : 104–19.

The genus *Ribes* presents many examples of interspecific hybridization and seems to offer a particularly favourable field for wide crossing. Already 45 interspecific hybrids are known and the most recent work has produced an extensive experimental material and indicated great future possibilities.

The genus has been divided into the following groups : *Ribesia*, *Coreosma*, *Grossularioides*, *Grossularia*, *Parilla* and *Berisia*. Interspecific hybrids are known within each of these groups except *Grossularioides*. Hybridization is also possible between species from different groups, even species morphologically and biologically very far removed one from the other.

Interspecific hybrids display varying forms ranging from high fertility, as in the case of *R. pallidum* Otto and Dietr. (*petraeum* x *rubrum*), *R. hounghtonianum* Jancz. (*rubrum* x *vulgare*), *Ribes Gonduini* Jancz. (*petraeum* x *bullatum* x *vulgare*), to complete sterility.

Cytological investigations have been made of 18 species and 9 hybrids, belonging to 5 distinct sub-genera. They all possess the same number of chromosomes. This phenomenon, according to Tischler, has been observed in the dicotyledons only in genera with a small number of species. Hybrids have so far not been observed in the wild state. The first cases of the discovery of hybrids are quoted.

The extensive work of Janchevskii, in which the hybrid nature of many of the garden varieties was disclosed, a number of new hybrids made and the inheritance of certain characters worked out, is briefly passed in review. One of the most interesting of his hybrids is *R. recens*, a hybrid of three good species and characterized by a fairly high degree of fertility.

Reference is made to the work of Lorenz in combining large fruits with resistance to *Sphaerotheca mors uvae* by interspecific crossing, and the segregation in other crosses of thornless types.

Various attempts to find a cytological explanation of sterility are cited, followed by the discovery of the differences in size, then form, of the chromosomes composing the garniture of a species and of the chromosomes of different species, of certain irregularities in the reduction division in sterile species, of allosyndesis detected in species whose parents differed in chromosome size and form and the pollen irregularities consequent upon this. The sterility increases with the differences in size of the two chromosome sets. Cells containing only univalents divide regularly and may give diploid gametes. The possibility of obtaining polyploids from sterile hybrids in this way is emphasized.

A table is given shewing the parentage of a large number of hybrid species of *Ribes*.

500. HEERMANN, W. 634.73:575
Weitere Beiträge zur Heidelbeerzüchtung. **(Further notes on bilberry breeding.)**
Der Züchter 1932 : **4** : 1–8.

A large collection of different species of *Vaccinium* has been made. A considerable degree of self-sterility is manifested.

The common bilberry has the disadvantage of a shallow root system and a consequent low frost resistance. Some of the American cultivated and hybrid varieties of *V. corymbosum* are superior in these respects and have very vigorous growth, upright bushy habit and fruit in clusters ; the proportion of seeds is also much lower than in the wild type. They require much higher soil moisture than that offered by German soils however. For this reason *V. pallidum* is more suited to German conditions.

The characters of a number of other species are described, with indications of their chromosome numbers and their possible merits as parents.

501. FEDOROVA, N. J. 634.75:575:016
(Résumé of the genetical literature on the genus *Fragaria*.)
Bull. Appl. Bot. Genet. and Plant-Breed. 1930-31 : **25** (5) : 120–34.

The object of the résumé is " to collect the genetical data on *Fragaria* from the beginning of investigations up to the present time." These investigations have been along four distinct

lines, viz. (1) the inheritance of qualitative and quantitative characters ; (2) cytology and interspecific hybridization, (3) the question of sex, (4) the phenomenon of apogamy. The literature on these four branches is reviewed, the cytological behaviour of interspecific hybrids and the origin of *F. grandiflora* being discussed at some length.
A rather full treatment is given also to the inheritance of sex and the practical value of a knowledge of the genetic behaviour of sterility.

502. Moog, H. 634.835.09
Beiträge zur Ampelographie. (**Notes on ampelography.**)
Mitt. Preuss. Rebenveredlungskommission 1930 : Nr. **6** : 103 pp.
The value of the various characters used in classification is discussed. The author then gives descriptions of a large number of American varieties and hybrids with a discussion of their origin and their merits and demerits. The primary object of the study was to attain a means of purification of the varietal collection, a great many types having in practice become extremely mixed. The author emphasizes the necessity of considering not only one but all characters of the plant and considers the nature of the sex of the flowers to be a constant hereditary and therefore good diagnostic character.
From this point of view cytology does not help since all the varieties had 19 chromosomes.

503. Ravas, J. F. 634.835.094
Les hybrides P.D. en 1931. (**Hybrid direct producers in 1931.**)
Rev. Vitic. Paris 1931 : **38** : 341–43.
The year has been very unfavourable but the new hybrid direct producers have suffered less and yielded more than the old *viniferas*, giving at the same time a wine of excellent quality. One of these hybrids has even been preferred, on the score of quality, to the famous Gamay.

504. Faes, H., Benvegnin, L. and Piguet, G. 634.835.094(49.4)
Observations sur les producteurs directs (P–D) dans le vignoble vaudois. (**Observations on direct producers (DP) in the vineyards of the Canton of Vaud.**)
Annu. Agric. Suisse 1931 : **32** : 311–67.
An indication is given of the qualities which should be indispensable in a direct producer hybrid and the methods of selecting the hybrids. There follows a description of various numbers which are considered promising and of others which have been recently rejected.
Three numbers, with red grapes, are regarded as outstanding and of definite promise ; these are Seibel 1000 and 5455 and Oberlin 604. A wine of very adequate quality is produced by mixing these three varieties in proportions which are indicated. None of the white ones was comparable the variety Chasselas grown at present.

505. Bramble, W. C. 634.972:581.143.26
Breaking the dormancy of tree seedlings by chemical treatment.
Science 1932 : **75** : 193–94.
The stimulation to growth renewal usually supplied by winter cold could be substituted by exposure to ethylene chlorhydrin vapour.

506. Rubashevskaia, M. K. 635.13:576.16
(**Observations on the wild carrot in cultivation and under natural conditions.**)
Bull. Appl. Bot. Genet. and Plant–Breed. 1931 : **26** (2) : 194–252.
The material consisted of wild specimens of *Daucus Carota* L. collected in Central Asia, near Tashkent and in the European portion of the U.S.S.R. near Kharkov, supplemented by herbarium material.
The Kharkov types were distinct with respect to a number of morphological features ; these differences are described, tabulated and discussed.

The two types are given the status of subspecies, named *orientalis* and *occidentalis*, and latin diagnoses are given.
The more detailed comparison of the two subspecies revealed a clear parallel variation in many of the more minor characters. A number of characteristic types within each subspecies are described. A study of the geographical distribution of these types shews that particular types are characteristic of particular localities, the extreme types at the extremes of the area of distribution being connected by a series of intermediate types.
An account is then given of observations on wild carrots. These were ascribed to one or other of the subspecies but very many of them were intermediate.
Many of the wild plants were subjected to self-pollination by isolating the whole plant and individual umbels. A considerable quantity of seed was obtained, which germinated quite satisfactorily, giving normal plants and indicating the possibility of inbreeding.
The wild forms were characterized by a much greater degree of polymorphism than the cultivated forms. The subspecies *orientalis* contains more individuals approaching to the cultivated type and this is thought to be the probable progenitor of a number of cultivated varieties. The subspecies *occidentalis* and also *D. maximus* have probably also taken part in the origin of other cultivated varieties. It is highly probable that hybridization between these and possibly other species as well, has been responsible for the great variety of forms.

507. Sinskaia, E. N. 635.15:576.16

(The wild radish from the sea-coast of Japan in connection with the problem of origin of the cultivated forms belonging to the genus *Raphanus*.)

Bull. Appl. Bot. Genet. and Plant–Breed. 1931 : **26** (2) ; 3–58.

A number of wild forms of radish was observed in certain isolated regions in Japan. The plants are described. The authoress, on considerations of habit and distribution, considers these as truly wild specimens and not as " escapes."
A study of these wild plants revealed a lack of homogeneity, variation occurring in a number of morphological characters.
A sketch is given of the geographical distribution of the genus and the classification of the genus is discussed briefly.
The authoress then passes to the question of the origin of the cultivated forms. The European forms are distinct from the Japanese forms. The European forms have probably descended from the wild maritime forms, possibly through a stage such as is now known in Egypt, where the plant is widely spread as a weed. The Chinese forms are less distinct than the Japanese and have probably contributed, as a result of introduction and subsequent hybridization, to the polymorphism of the European forms. The present day Japanese cultivated forms have almost undoubtedly arisen direct from the wild forms.
The genus is regarded as having existed in the Lower Tertiary as an undivided but heterogeneous population along the coast of the Mediterranean. From this population complexes of forms later separated out, giving the nuclei of the present geographical groups. The genus still in a manner constitutes one system, in that all the species are interfertile.
Latin diagnoses for the species are given.

508. Rasmusson, J. 635.34:575.12
635.34:575.14

Results from a cross cabbage x savoy cabbage.

Hereditas 1932 : **16** : 241–48.

Three separate F_1's were investigated, all proving rather uniform compared with common cabbage varieties. The wrinkled leaf of the savoy was dominant, the waxiness of the leaves, frost resistance, firmness of head were intermediate, a sort of incomplete dominance being observed with regard to the loose savoy type, as also with respect to earliness. The flavour was superior to either parent, lacking the pronounced taste of the cabbage but with all its juiciness.
The F_1 plants exceeded both parents in fertility. They exceeded the parents very markedly also in head size.

An F_2 was obtained by selfing. Observations on this shewed that it might be possible to select a non-wrinkled type, the full cabbage taste did not reappear and the best heads weighed about equal to the average of the parents. The F_2 plants were highly self-sterile. A very small F_3 was thus obtained and all the plants were abnormal. The effects of inbreeding are thus quite pronounced. Even the F_2 obtained by intercrossing F_1 plants was not in general of much value. Certain lines possessing the desirable combination of characters have since been isolated by this method however.

509. HIRATA, K. and YAMAMOTO, K. 635.41:577.833
(On the occurrence of female intersexual plants in *Spinacea* and *Melandrium*.)
Jap. J. Genet. 1931 : **7** : 106–07.
By selfing intersex plants only females and intersexes occurred in the progeny, males were entirely absent. The intersexes used were therefore regarded as being genetically female.

510. KANDA, T. 635.615:575.061.6:581.48
(The inheritance of seed-coat colouring in the water-melon.)
Jap. J. Genet. 1931 : **7** : 30–48.
Six types of ground colour of the seed coat were identified and five kinds of pattern.
A genetical analysis was made of three types of ground colour and three patterns by suitable crossings among varieties of *Citrullus vulgaris* Schrad. For these, seven allelomorphic pairs were found :—
A, B, C, the factors for ground colour,
T, for reddish brown over the whole surface,
M, for localized black spots on the " Samenschwiele,"
H, in the presence of M, for black dots on the whole surface,
K, the extending factor for black colour of dots to the whole surface, revealing solid-black.

511. SLEETH, B. 635.615–2.484:576.16
Physiologic strains of *Fusarium niveum*. (Abst.)
Phytopathology 1932 : **22** : p. 24.
The probable existence of 23 forms attacking water-melons has been indicated.

512. SINNOTT, E. W. 635.623:575.11–181:581.47
635.623:575.11.061.1:581.47
The independence of genetic factors governing size and shape in the fruit of *Cucurbita pepo*.
J. Hered. 1931 : **22** : 381–89.
A cross was made of two pure lines differing markedly in shape and size, line A having nearly spherical fruits of about half the weight of the disc-like fruits of line B. The disc shape was completely dominant to the sphere, monohybrid relations being evident in F_2, with a slight excess of recessives.
The spherical F_2 segregates on measurement proved to be significantly larger than the spherical parent, whereas the disc segregates were significantly smaller, the size of both spheres and discs being essentially the same. It is clear that weight is inherited independently of shape and it is probably conditioned by a series of multiple factors.
Examining length separately, there was an approximation to a 3 : 1 ratio, but variability was very high. Width gave a smooth curve. The author concludes from this again that the factor controlling shape acts independently of the factors which influence the amount of material. Specific length and breadth factors are thought not to exist.

513. 635.64Pritchard
635.64–2.484–1.521.6
New tomato named for Pritchard.
Off. Rec. 1932 : **11** : p. 16.
A highly wilt resistant variety has now been issued under the name Pritchard.

514. LINDSTROM, E. W. and KOOS, K. 635.64:576.356.5
Cyto-genetic investigations of a haploid tomato and its diploid and tetraploid progeny.
Amer. J. Bot. 1931 : **18** : 398–410.
A haploid plant arising, apparently by parthenogenesis, in a varietal cross, has been under observation for some years, having been propagated vegetatively. The plant is smaller than normal and highly sterile, although the sexual organs were perfectly normal. It has remained quite constant.
A few plants have been obtained by self-fertilization and these proved to be fully fertile diploids. A number of diploid, as well as haploid shoots were obtained by a special method of obtaining cuttings from decapitated plants. These diploids have been converted by the same method into tetraploids.
The chromosome behaviour at metaphase is described for the haploids. There was a frequent tendency for more chromosomes to go to one pole than the other and " one may expect to find rare instances in which the entire group of 12 chromosomes has gone to a single pole." The distribution of the chromosomes is quite chaotic and multipolar spindles were often observed. Some chromosomes occasionally split, so that the number of chromosomes exceeds the haploid number 12.
The reduction division in the derived diploids was quite normal.
Cytological examination of the callus giving rise to the diploids revealed various irregularities which might have given rise to chromosome duplication.
The derived diploids proved to be completely homozygous for qualitative characters. The variability in fruit size was very low for these and for normal inbred lines.
The fruits of the tetraploids were smaller than the diploids and contained a very low proportion of good seed. They had 12 sets of quadrivalent or tetrasomic chromosomes, which at diakinesis associated in rings and other configurations of four. Microsporogenesis was exceedingly regular.
The recessive gene p, which in the diploid condition gave pubescent fruits, in the haploid produced no pubescence and in the tetraploid very pronounced pubescence.

515. NEWHALL, A. G. 635.64-2.44–1.521.6:575
A greenhouse tomato hybrid somewhat resistant to *Cladosporium* leaf mold. (Abst.)
Phytopathology 1932 : **22** : 20–21.
In crosses involving two resistant English strains and American market varieties susceptibility was dominant and a number of resistant segregates appeared in F_2. By continuing up to F_5 promising resistant strains of mid-size red tomatoes have been procured.

516. LESLEY, J. W. 635:64–2.8–1.521.6
The resistance of varieties and new dwarf races of tomato to curly top (western yellow blight or yellows.)
Hilgardia 1931 : **6** : 27–44.
In extensive tests using both natural and artificial infection, the variety Dwarf Aristocrat and most of the dwarf hybrids of this variety were resistant. The resistance is conditioned either by the *d* gene for dwarfness or by a gene closely linked with it. One standard variety, Red Pear, was also resistant.
Some of the F_6 dwarf progenies combine resistance equal to that of the dwarf parent with large size and good quality of fruit for canning, being at the same time earlier than Santa Clara Canner, the susceptible parent.
The resistance is only weak and is greatly influenced by external conditions. It seems to be due mainly to a tendency to escape infection.

517. CREBERT, H. 635.651:575
Beobachtungen bei der Kreuzungszüchtung mit der Pferdebohne. **(Observations on cross-breeding in broad beans.)**
Der Züchter 1931 : **3** : 360–64.

Extreme varietal differences do not exist in the broad bean and crossing was carried out mainly between local and commercial strains. A well-defined heterosis was observed in F_1, which had strikingly well developed beans in comparison with the next and later generations. Considerable segregation occurred in these generations. Observations on time of ripening confirmed the view that early plants have beans of darker green than later plants within the same lines.

In crosses of early and late varieties earliness tended to be recessive. Early flowering was inherited together with early maturity and homozygous lines could be established with ease. The early lines seemed however to be invariably poor pod producers and their beans were large and of poor quality.

Vigorous development in the early stages was not always associated with high yield ; such plants tended to mature later than less vigorous plants. No clear index of yield on which to base selection has yet been discovered.

The amount of cross-pollination varied for different varieties and in different years. An average of 7 per cent cross-pollination was observed. The highest percentages were observed in the strains which gave the highest yields and the author argues that a too rigid purification of the lines is undesirable.

Chlorotic plants often appeared on crossing, in some crosses more than in others. Differences were also observed in disease resistance.

Observations made over ten years on 43 different combinations of 12 varieties and 16 of the author's own lines shewed that earliness, weak straw development, development of the first pod close to the ground, vigorous branching and flat large beans of the " Marsch " type are inherited together ; Böcker's Butjadinger transmits a low bean quality and often leads to the segregation of *Vicia faba major* types, reduced disease resistance and variations in bean colour ; Lohmann's Weender transmits its high yield, excellent bean and suitability to Bavarian conditions. The characteristic behaviour of a number of other varieties in crossing is similarly indicated. The type required is one suited to variable, cold and damp climatic conditions.

518. SIRKS, M. J. 635.651:575.182
Plasmatic influences upon the inheritance in *Vicia Faba*. I. The elimination of a whole linkage group in the plasm of *Vicia faba* minor.
Proc. Acad. Sci. Amst. 1931 : **34** : 1057–62.

In a number of crosses between *Vicia faba minor* and *Vicia faba major* it was observed that the crosses in which *major* was the female parent gave normal segregation for a number of plant and seed characters studied, whilst the reciprocals shewed a complete absence of the recessive segregates for the characters, with regard to which the *minor* plant contained the dominant. With regard to characters in which the *minor* was recessive there was a shortage of dominants, resulting in ratios approximating to 2 : 1 in place of 3 : 1. There was also a 25 per cent abortion of seeds.

The factors involved all belong to the same linkage group and the author considers that the chromosome in which they lie is of such a nature that the homozygous combination of it in *minor* plasm is non-viable.

519. SIRKS, M. J. 635.651:575.182–181
Plasmatic influences upon the inheritance in *Vicia faba*. II. Different plasmatic reactions upon identical genotypes.
Proc. Acad. Sci. Amst. 1931 : **34** : 1164–72.

In studying crosses heterozygous for various members of the series G_1—G_4 of growth factors which influence stem length, leaf dimensions and fruit length, reciprocal crosses were observed to give identical results except in crosses between *Vicia faba major* and *Vicia faba minor*. Here the growth factors produced a more marked result in the *major* plasm with regard to the stem length, the reciprocals were identical with regard to leaf dimensions and the factors were more active in *minor* than *major* plasm with regard to fruit length.

520. SIRKS, M. J. 635.651:575.182.061.6
Plasmatic influences upon the inheritance in *Vicia faba*. III. The elimination of a definite factor (variegated) as caused by the type of plasm.
Proc. Acad. Sci. Amst. 1931 : **34** : 1340–46.
The behaviour of a number of multiple allelomorphs and other factors determining the leaf colour is stated. The factor A for typical green is epistatic to the rest. In presence of A, V for variegation segregates normally but in its absence (" subtypica ") there is an excess of variegated segregates in F_2. The gametes carrying the recessive v factor are evidently eliminated in *variegata* plasm. The small number of self-colour plants occurring are genetically variegated and only phenotypically " subtypica." In " subtypica " plasm the reverse condition holds, viz. the offspring are all either heterozygous variegated or true " subtypica," owing to the elimination of the gametes carrying the dominant V.

521. KOOIMAN, H. N. 635.652:575:016
Monograph of the genetics of *Phaseolus* (especially *Ph. vulgaris* and *Ph. multiflorus*.)
Bibl. Genet. 1931 : **8** : 295–409.
A very full discussion of the genetics and related subjects, based on reference to 138 monographs and articles. General questions of biology are first touched upon, then the genetics of a number of qualitative characters, followed by quantitative characters and terminating with resistance and immunity to disease.

522. LAMPRECHT, H. 635.652:575.061.6:581.48
Beiträge zur Genetik von *Phaseolus vulgaris*. Zur Vererbung der Testafarbe. **(Contributions to the genetics of *Phaseolus vulgaris*. The inheritance of testa colour.)**
Hereditas 1932 : **16** : 169–211.
The colours which appeared are described in detail, with reference to three standard sets of colour charts, since much of the confusion in the past has been the direct result of omission of such detail.
The basal factor for colour, in whose absence, or presence without any of the other factors, no development of colour can take place, is designated P. In the presence of P, C gives sulphur white beans. A further factor producing pale ecru is designated J ; this factor conditions a similar colour in the hilum. In presence of all three of these factors the colour shamois results. In all cases where C is heterozygous the seed coat is mottled. The shamois is changed by G to " bister " (yellowish-brown), by B to golden bronze green, by V to violet purple. Shamois in presence of G and B gives mineral brown, G and V maroon, B and V, both heterozygous, dark dull green, and B and V either being homozygous or in presence also of G, black.
The F_2 results of a number of crosses of different combinations of pure line parents, on which results this factorial interpretation is based, are given. Apart from the cases indicated, there was no difference observable between the homozygous dominants and the heterozygotes, except in one case to which attention is drawn. In this case out of 94 black F_2 segregates 12 were noted as having a slight greenish tinge and F_3 results shewed these to be heterozygous for B and V and double recessive with respect to G. The F_3 and F_4 results supported the F_2 classification throughout. The genes G, B and V are apparently inherited independently, as also C and J.
Segregation of an exactly similar type was observed in a number of plants obtained from rogues in commercial seed, which were evidently the result of natural cross-pollination. The probable factorial composition of the rogues is given.
The results leave no doubt of the fact that the basal factor P alone produces no colour, contrary to the assumptions of the majority of previous authors.
The results of previous authors are discussed and the results of many of them are fitted in to the present factorial scheme and their rather vague colour descriptions interpreted in the light of the present author's results.

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